

DISSERTATION
ON THE
CHEMICAL & MEDICAL PROPERTIES
OF THE
BRISTOL
HOTWELL WATER.

TO WHICH ARE ADDED
PRACTICAL OBSERVATIONS
ON THE
PREVENTION & TREATMENT
OF
PULMONARY CONSUMPTION.

By *A. CARRICK, M. D.*

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BRISTOL HOTWELL WATER.

PART I.

*The Chymical Properties of the Hotwell
Water.*

THE Analysis of Mineral Waters is justly accounted one of the most difficult departments of Chemistry, and the extent of the difficulty can be understood by those only who have made the attempt. Besides a knowledge of the various chemical phenomena, a certain facility and neatness in conducting experiments to be acquired only

by practice, is indispensibly necessary; together with unwearied perseverance in repeating and varying the processes, as they often afford at best only an approximation of the truth.

In conducting the following experiments, great regard was paid to accuracy, and much time bestowed on them, which might perhaps have been better employed; but as they were chiefly undertaken as a chemical exercise, my pains have not been unrewarded: and, as no analysis of these waters has been made public since the recent improvements in chemistry, the present may afford the reader some information as well as amusement.

As a great deal must necessarily depend upon the purity of the Reagents in researches of this sort, those employed in the following analysis were prepared either by Mr. Willis, of London, whose accuracy is sufficiently known, or by myself. The articles found in the shops are totally inadmissible for such purposes.



Where the heat of fire was required, a furnace after Dr. Black's model, or that of Mr. Watt's Pneumatic Apparatus was employed, being a security from dust and accidents.

The materials to be weighed, were always dried as nearly as possible to the same degree, by being placed for a certain time upon a tin plate heated by boiling water. The bits of paper used as filters, and the cotton threads employed as syphons, were dried by the same means, and weighed previously to being used.

The Balance for small weights is perfectly sensible to the fiftieth part of a grain: That for large weights is readily turned by a grain, with four pounds in each scale.

The distilled water was prepared in glass retorts from snow water.

But in spite of every precaution, I am well aware that some inaccuracies may have taken

place; indeed the present state of chemistry improved as it is, renders it unavoidable: but I trust they are too insignificant to affect the result in any sensible degree.

DESCRIPTION of the HOTWELL.

Previously to entering upon the analysis of the water, it will be proper to give some description of the fountain from whence it proceeds and the ground through which it flows.

The new Hotwell is situated at the bottom, and nearly at the Southern extremity of St. Vincent's Rock, on the Gloucestershire bank of the river Avon, and about a mile below the city of Bristol.

Before it was inclosed in its present form, the spring issued from the sloping bank about 26 feet below high water mark, and 10 or 12 above low water, and was received into one or more troughs or basons for the purpose of bathing in, and washing of sores, and of course was accessible only at low water.

About a century ago, it was surrounded with a case of mason work, in order to defend it from the water of the river, and force it to rise to the level of the beach: but it was found impossible when it had accumulated to a certain height to prevent it from escaping by some other outlet. The inclosure was therefore furnished with valves at bottom to prevent the influx of the river water, and allow an issue to the mineral water during the time of ebb. A pump is employed to raise the water for use, immediately as it issues from the rock, and the whole contrivance is found to answer perfectly well at all hours during the neap tides, but the water is said to be rendered sensibly colder and somewhat turbid, at the equinoctial spring tides, when the river rises to the height of 36 feet perpendicular. For this reason, the water is not drunk during the time of flood on those days; but at low water it must be equally good as at any other season.

The spring is extremely copious, discharging nearly forty gallons in the minute.

The water is inodorous, exceedingly limpid, sparkling and pleasant to the taste, and when newly drawn numberless air bubbles are seen rising to the surface, or adhering to the sides of the glass.

The heat of the water as it issues from the pump, is $74 \frac{1}{2}$ degrees of Fahrenheit, taking the average of several good Thermometers; and I have not observed the temperature to vary in any sensible degree at the highest spring tides, provided the pump had been previously kept working for some hours.

The specific gravity of Hotwell water, is 1.00077.

The rock which rises immediately behind the well to the height of 200 feet, consists chiefly of strata of very hard lime stone of various colours, intersected with numerous fissures in which are found abundance of Calcareous and Quarzose Crystals, the latter known by the name of Bristol diamonds.

Upon the surface of this calcareous rock there is found in most parts strata, or masses of iron ore, a few feet in thickness, in some places tolerably pure, but generally combined with much quartzose and micaceous matter, forming a stone used in building. Over all is a bed of stiff red clay, of unequal thickness.

Calamine, and ores of Lead, have been found on the neighbouring downs, and even on Clifton hill in small quantities, and near the surface.

The strata both of lime-stone and iron-stone, are inclined from north to south, at an angle of about 50 degrees to the horizon.

The rocks on the opposite side of the river have nearly the same arrangement, and by the coincidence of their projections and depressions would seem to have been once continuous, and rent asunder by some convulsion, whereby Clifton and Durdham down were separated

from the corresponding elevated plain of Leigh-down, and a new outlet formed for the Avon. As, however, the opposing strata do not correspond with each other in thickness, and are both inclined in the same direction, it appears probable that the whole of the eastern bank has slid from off the western, so that the lowermost stratum of the eastern bank, which is now buried in the earth, rested originally on that which forms at present the uppermost stratum of the western bank.

Nearly a mile below, and on the same side of the river, is the Old Hotwell, which with similar general properties, differs a little from the new in temperature, being a few degrees colder; for which reason, and its greater distance, and difficulty of access, it has of late years fallen into disuse. It rises about 40 feet above the level of the new Hotwell spring, and is probably derived from the same source.

About three years ago the late Mr. Morgan

sunk a well from the top of St. Vincent's rock some way to the eastward of the Hotwell, with a view of falling in with the spring, and after perforating to the depth of 240 feet, which is considerably below the level of the Hotwell, a plentiful vein of water was found which is now raised by means of a steam engine. Mr. Green, an intelligent and ingenious watch-maker, at the Hotwells, who went down when the water was first discovered, informed me that the stream issued from a fissure on the east side of the rock, as ascertained by the compass, and raised two thermometers, with which he was provided, to 66 degrees.

Several wells have been sunk in different parts of Clifton-hill for the accommodation of private families. The water is found at various depths, from 160 to 60 feet, in proportion to the distance from the edge of the precipice. Near the foot of the hill, along the eastern side, water is found very near the surface, and in one part issues spontaneously in a copious stream

called Jacob's well, which is partly conveyed in pipes to Bristol. The water of all these springs is exceedingly good, and pleasant to the palate; but neither warm nor sparkling like the Hotwell water.

The reason of this difference, and the cause of heat in the Hotwell water, is not likely to admit of a satisfactory explanation.

That subterraneous fires impart heat to fountains in their vicinity, is evident from the hot springs in the neighbourhood of Hecla, Solfatara, and other volcanoes; but it does not necessarily follow, that such fires must be the cause of heat in every thermal water. Various chemical combinations are attended with heat, and it is possible at least, that the formation or decomposition of some of the ingredients of this water, might impart the degree of heat it possesses. The vitriolic acid, for example, would produce heat in the formation of selenite with the lime-stone of the rock through which it passes, and detach

at the same time, the carbonic gas with which the water is impregnated. Various suppositions of this sort might account for the phænomena ; but suppositions, however plausible, do not amount to proof, and it would reasonably be objected, that the wells in the neighbourhood, although they contain felenite, and most of the other ingredients of the Hotwell water, in some degree, are not warm.

THE FOLLOWING

PRELIMINARY EXPERIMENTS

Were made in order to obtain some idea of the contents of the Hotwell Water.

Exp. 1. Infusion of Lacmus is rendered scarce perceptibly of a deeper blue.*

2. Infusion of Brazil wood is scarce perceptibly altered towards a purple shade.

* In using these infusions, or syrup of violets, equal quantities of the reagent is put into two similar glasses; one of which is afterwards filled with distilled water, and the other with the mineral water; and in this way the smallest quantity of acid or alkaline matter becomes apparent. In making this experiment, the greatest care is necessary to have the distilled water free from carbonic acid, as well as other impurities.

3. Paper stained with the above infusions, or with turmeric, is not perceptibly altered.

4. Syrup of violets is rendered of a darker blue or dirty green.

The smallest quantity of an alkali, produces a very different and brighter green.

The tenth part of a grain of calcareous spar finely powdered, and suspended in an ounce of distilled water, produces exactly the same shade, when mixed with the above-mentioned infusions or syrup of violets.

5. Letters written with solution of acetated lead were not rendered visible by being dipt in the water; or held over its steams when boiling.

6. Lime-water causes an instant precipitation.

7. As do the fixed and volatile alkalis.

8. Neither of the mineral acids occasion any perceptible change.

9. Acid of sugar causes a precipitation of saccharated lime, insoluble in any acid.*

10. Muriated barytes occasions an immediate precipitation, insoluble in muriatic, or any acid.

11. Nitrated Silver causes an instant precipitation insoluble in nitric, or any acid.

12. Prussian alkali causes no precipitation.

13. Nor does Tincture of Galls.

* Although saccharated lime is not soluble in the strongest acids, nor in pure water, a small quantity of any of the mineral acids dropt upon it, and triturated with it, renders it easily soluble in a moderate quantity of water.

Many more experiments were made with other reagents; but these seem perfectly sufficient to indicate the nature and contents of the water.

Experiments 1, 2, 3, and 4, indicate the presence of some alkali, or earthy substance, uncombined with the mineral acids; but in very small quantity.

Exp. 5, demonstrates the absence of hepatic gas.

Exp. 6, the presence of carbonic acid gas.

Exp. 7, the presence of some earthy salt.

Exp. 8, the absence of barytes.

Exp. 9, the presence of calcareous earth.

Exp. 10, of vitriolic acid.

Exp. 11, of muriatic acid.

Exp. 12, and 13, demonstrate the absence of iron.

EXPERI-

EXPERIMENTS

FOR ASCERTAINING

The GASEOUS FLUIDS with which the
Water is impregnated,

VARIOUS methods of collecting the gasses of mineral waters have been devised, none of which, it must be confessed, is perfectly accurate.

A process for this purpose is described in Bergman's analysis of Seydschutz water, and since improved and recommended by other writers; in which the air is received into an inverted jar full of warm water, placed over an aperture in the lid of the vessel in which the water of the experiment is boiled; taking advantage of the property of water not readily

absorbing the gasses, when heated above 120° of Fahrenheit.

But although the process appears at first sight very plausible, I have found it after repeated trials, with instruments of various forms, always very unmanageable and uncertain, for reasons which must indeed present themselves upon a more attentive consideration of the subject without making the experiment, and which I need not consume time in pointing out. The indefatigable Swedish chemist, sensible of these imperfections, was soon induced to abandon this method for another equally simple, and more accurate :—a retort with the neck bent at the extremity, so as to be introduced into an inverted receiver filled with mercury : But beside the large quantity of atmospheric air which must necessarily be left in the neck and upper part of the retort, it will be found impossible to prevent the water from distilling over in considerable quantity and occupying part of the mercurial jar, and of course re-absorbing a part

or perhaps the whole of the gas expelled from the retort, if the ebullition is continued a sufficient length of time for the expulsion of the carbonic acid which adheres in part for several hours.

With a view of obviating this defect, I employed oil instead of mercury, which, owing to its less specific gravity, would float upon the surface of the water as soon as the steam was condensed into water: but I soon perceived that oil possesses a considerable disposition for the absorption of gasses, and the experiment therefore could be of no avail.

In order to obviate, as far as possible, these inconveniences, I caused an alembic to be made, into which the end of a barometer tube was inserted, being very accurately ground. The other end of the tube was bent nearly in the form of the letter S, for the purpose of being introduced under a mercurial receiver. The air contained in the tube of 36 inches in length, does not ex-

ceed a cubic inch, and as the alembic may be filled with the water, except only about a 25th part of its content, (equal to the expansion of water when heated to the boiling point) the quantity of atmospheric air included in the whole apparatus may be very inconsiderable. The water being poured in, the tube inserted, and the joining well secured by a proper luting, the alembic is placed upright in a sand bath, and the bent end of the tube introduced into the inverted receiver. If the heat is applied gently and sparingly, so that the ebullition shall be moderate and slow, very little steam passes over, being mostly condensed in the tube, through which it descends again into the alembic.

This suggested to me the idea of causing the tube to pass through a refrigeratory, formed of a tin canister, about 18 inches long and 4 in diameter, filled with cold water, by the assistance of which the steam is still more perfectly condensed; yet when the ebullition is conti-

nued for some hours, a small quantity of water always finds its way into the receiver, although not sufficient to affect the experiment in any sensible degree.

The alembic with which I made this experiment was filled with the water at the pump-room and carefully corked, and conveyed home inverted, in order that none of the gas might escape or be extricated.

It contains exactly 10390 grains of Hotwell water at the temperature of 60° which is equal to 41.038 cubic inches, or 22oz. and 6 drachm. measures very nearly.

Having poured out a certain measure of the water, which I knew from previous experiment to be equal to 510 grains, the tube was instantly inserted, and the apparatus placed on the furnace as above described. It is to be observed, that the quantity of atmospheric air included in the apparatus was thus made to be very

exactly three cubic inches, the tube containing 250 grains of water, which joined to the 510 poured out of the alembic, make 760 grains, or 3 cubic inches of water. There remained in the alembic 9880 grains, which is equal to 39 cubic inches very nearly.

After a slow ebullition of three quarters of an hour, the apparatus was removed from the fire, as some drops of water began to be perceivable above the mercury, and it was found that 7.75 cubic inches of mercury was displaced, after the receiver had been cooled to the temperature of the room, which was about 60°.

But it is necessary to remark, that the volume of air in the mercurial receiver, is not the exact measure of the air expelled from the apparatus; as it must necessarily be in a less compressed state than the air of the atmosphere, owing to the column of mercury still remaining in the receiver. For the density of the air

of the atmosphere will be to the density of the air in the receiver, as the height of the mercury in the barometer at the time, is to that height *minus* the height of the column of mercury remaining in the receiver after the operation is finished.

Therefore calling the density of the atmosphere D and the density of the air in the receiver d , the height of the mercury in the barometer (which was at the time 29 inches) H , and the height of the mercury in the receiver (which was exactly 2 inches) h : Then $D:d :: H:H-h$ Or $D:d :: 29:27$. Or, in other words, the volumes of air are in the inverse ratio of their superincumbent weight; and the real volume of the 7.75 cubic inches in the receiver, when reduced to the atmospheric density, is $\frac{7.75 \times 27}{29} = 7.215$ cubic inches.

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But as there was at the commencement of the operation 3 cubic inches of atmospheric air included in the apparatus, when this is sub-

tracted from the air in the receiver, there remains only 4.215 cubic inches for the volume of gas expelled from the water by boiling.

After having carefully marked the height of the mercury in the receiver, some lime water was introduced in its place and agitated with the gas, the volume of which, after some hours standing, was found to be reduced to 3.5 cubic inches, which subtracted from 7.215 leaves 3.715 cubic inches for the volume absorbed by the lime water, or carbonic acid gas. The remaining 3.5 cubic inches I could not distinguish from atmospheric air by any means in my power. Of this 3 cubic inches was originally included in the apparatus; the remaining .5 must therefore have been extricated from the water.*

* To render this part of the experiment perfectly correct, a reduction of the volume of the 3.5 cubic inches ought to be made, on account of the column of water in the receiver, as was formerly done on account of the mercury; but the influence of 3 or 4 inches of water is too inconsiderable to render a calculation necessary.

According to this process, a gallon of Hot-well water or 231 cubic inches, is impregnated with 22.003 cubic inches of carbonic acid gas, and 2.96 of respirable air, making together 24.96, or 25 cubic inches very nearly.

The ingenious Dr. Gioanetti of Turin, in analysing the waters of St. Vincenzo, endeavoured to ascertain the quantity of carbonic gas upon principles entirely different from the foregoing; calculating from the weight of the chalk which it precipitates from lime water.

By this means the quantity of carbonic acid in any water can be estimated, with very little trouble or expence, provided the experiments made to ascertain the relative quantities of earth and acid in chalk, are accurate; and provided the same proportions obtain in natural and artificial chalk.

Unfortunately some difference takes place between the estimates of Bergman and Jacquin

on this subject; a hundred grains of chalk containing 34 grains of acid, according to the former, and 40 according to the latter, which leaves the matter in some uncertainty. But if a choice is to be made, I am inclined to rely upon the known accuracy of the Swedish chemist.

From a gallon of Hotwell water saturated with lime water* I obtained 43.63 grains of precipitate: but as a part of this might proceed from the decomposition of the muriated magnesia, with which we shall afterwards find the water to be impregnated, I saturated likewise a gallon which had been boiled for two hours in an open vessel and filtered, and from this I obtained 4.8 grains of precipitate, most of which dissolved readily in vitriolic acid. When

* This is most conveniently done by pouring a certain quantity of lime water into a large bottle, the content of which is previously ascertained with accuracy, and afterwards filling it up with the Mineral water as it runs from the pump.

this is subtracted from the 43.63 grains of the former experiment, it leaves 38.83 grains for the chalk precipitated by the carbonic acid of the water; which, according to Bergman's calculation, must have been 13.19 grains by weight.

Taking then, with Lavoisier, .44 grain for the weight of a cubic inch of carbonic gas, the volume of that gas contained in a gallon of the water would amount to 29.97 cubic inches.

This is considerably more than the quantity actually obtained in a gaseous form by the former experiment; but this difference is not difficult to account for, when we consider that the ebullition could not be continued a sufficient length of time for the expulsion of all the carbonic gas, which adheres after many hours boiling. This experiment therefore I consider more decisive with regard to the carbonic acid; but as the atmospheric and other gasses adhere but slightly, they can be accurately obtained

by the former experiment ; and both together cannot fail to come very near the truth. We may therefore estimate the gasses with which a gallon of Hotwell-water of 231 cubic inches is impregnated, as follows :

Carbonic acid gas 30 cub. inches.

Respirable air, 3 ditto.

Total, 33

EXPERIMENTS

TO ASCERTAIN

The Quantity of **SALINE** and **EARTHY**
MATTER in the Hotwell-Water.

Exp. 1. A Wine gallon of 231 cubic inches, or 58528 grains,* was slowly evaporated to dryness, in a cylindrical glass vessel, about 5 inches in diameter, and 8 deep, inclosed in a tin case, and heated by boiling water.

* I experienced some difficulty in obtaining the exact measure of a gallon, the ordinary pint measures not being sufficiently accurate for chemical purposes. I was allowed access to the standard measures preserved in the Guildhall of Bristol; but I found it impossible to fill any wide-mouthed vessel equally at different times. I therefore resolved to weigh the subject of the present experiment; taking, with Mr. Everard, 58483.4 grains as the weight of a gallon of distilled water, at the temperature of 55 degrees: and I found that an equal volume of Hotwell-water at the same temperature, weighed exactly 58528.7 grains, being 45.3 grains in the gallon, heavier than distilled water.

No perceptible odor arose from the water during the process.

A white ring like a thread was formed round the highest part of the vessel to which the water had reached, and a thin grey scurf covered the sides, to which it adhered very tenaciously when newly taken from the fire. The bottom of the vessel was covered with imperfect and confused crystallizations resembling flakes of snow, which adhered but slightly. The whole collected together formed a greyish powder, weighing $47\frac{3}{4}$ grains, which became moist by exposure to the air for some days, and increased in weight 6 grains.

2. This residuum was digested for some hours in three drachms of alcohol, which was afterwards carried off by means of a cotton thread, used as a syphon.* The operation

* I at first made use of bits of filtering paper for these purposes, but I found the thread syphons greatly preferable; the minute earthy particles frequently passing through the pores

was repeated a second time with a smaller quantity of alkohol, and the residuum, when dried, was found reduced to $38\frac{1}{2}$ grains, the alkohol having dissolved $9\frac{1}{4}$ grains.

3. The $38\frac{1}{2}$ grains insoluble in spirit of wine was digested some hours in half an ounce of cold distilled water, which was drawn off as in last exp. by the thread syphon. Small quantities of water were afterwards used to wash the residuum, which when dried, was found reduced to $24\frac{1}{4}$ grains.

4. The $24\frac{1}{4}$ grains of last exp. was boiled for half an hour in a quart of distilled water, and only $13\frac{1}{2}$ grains remained undissolved.— This was a grey or ash coloured powder, perfectly insipid, and which attracted no humidity nor weight from the atmosphere.

of the paper in spite of the greatest care. Besides a portion of the earthy matter always adheres to the paper notwithstanding every precaution, but none to the syphon if attentively managed.

We have thus out of $47\frac{3}{4}$ grains of residuum, $9\frac{1}{2}$ grains soluble in alkohol, 14 soluble in a small quantity of cold water, $10\frac{3}{4}$ soluble in 600 times its weight of boiling water, and $13\frac{1}{2}$ insoluble in either of these menstrua.

In the spirituous solution we are to expect calcareous or magnesian muriates, or perhaps nitrates, according to Bergman;* in the solution by cold water, a mixture of various neutral salts; particularly vitriolated soda, or Glauber's salt, muriated soda, or common salt, and vitriolated magnesia or Epsom salt; in the solution made by boiling water, we are to look for vitriolated lime, or selenite, alone; and in the insoluble residue, for carbonated lime and magnesia, and perhaps quartz; it being evident from the preliminary experiments, from the appearance of the residuum or of the water itself, and from an inspection of the gutters in which it runs,

* Nitrous salts very rarely occur in waters: and I believe never but in stagnant waters, or wells in the vicinity of marshes.

that neither iron clay nor barytes exist in the water.

5. Upon one half the residue insoluble in boiling water, distilled vinegar was gradually poured, which dissolved it entirely, with effervescence, and extrication of carbonic gas. The solution when diluted with water, was quite transparent.

Hence it is evident that neither silicious earth, nor clay in an uncombined state, is held suspended in the water ; the first being perfectly insoluble in acetic acid, and the latter very nearly so. But this proof of the absence of clay is not necessary ; for water in which clay in an uncombined state, is suspended, is always more or less of an opal colour ; whereas this is perfectly limpid.

6. Part of the acetic solution gave a copious precipitate to acid of sugar.

The remainder, by slow evaporation to dryness, was converted into a filamentous, moss-like substance, which did not in any degree deliquesce in a moist atmosphere.

Hence it appears that the residue under examination is carbonated lime only, without any mixture of magnesia: For acetated lime remains permanently dry; but acetated magnesia is very deliquescent.*

7. To render this conclusion more decisive, the remaining half of the $13\frac{1}{2}$ grains of exp. 4 was cautiously saturated with dilute vitriolic acid, some drops of a blue infusion being added to mark exactly the point of saturation. Upon afterwards pouring in some distilled water, a white powder remained at the bottom of the glass, and the water, when decanted off, was perfectly insipid, possessing none of the bitterness of Epsom salts.

* Vide Bergman's analysis of waters.

8. To this water a quantity of lime water was added which occasioned no precipitation of magnesia; but remained quite transparent.

This experiment I have many times repeated with the same result; but on one occasion I was a good deal surprised to observe some very thin and minute flakes of magnesia precipitated by lime water, which made me doubt the accuracy of my former observations. This I afterwards discovered to be owing to the china basin in which the water was evaporated having been suffered, by accident, to remain too long on the sand bath, whereby part of the muriated magnesia was decomposed. By repeating the process, I was satisfied of the fact, and in order still more clearly to ascertain the presence or absence of carbonated magnesia in the water, I made the experiment in the following way.

9. A quart of Hotwell water was evaporated to about one fourth. By filtration 2 grains of a white powder was obtained, which was after-

wards saturated with vitriolic acid. The earthy salt was washed with distilled water, which was carefully decanted off and poured into a phial along with a sufficient quantity of lime water, and no cloudiness nor precipitation whatsoever was produced, after many days standing.

From these experiments we are warranted to conclude, that the residue insoluble in boiling water is carbonated lime only, and that no carbonated magnesia exists in the Hotwell water.

10. The alcohol of exp. 2, which dissolved $9\frac{1}{2}$ grains, was evaporated by a gentle heat, and a substance was obtained in appearance like manna, very hot and pungent to the taste, and extremely deliquescent.

This was divided into three equal parts.

11. One of these dissolved in distilled water did not alter the infusion of brazil wood; gave

no precipitate to acid of sugar: nor to muriated barytes.

Hence it is proved to contain no calcareous earth, nor any sort of vitriolic salt; which last, indeed, are not soluble in spirit of wine.

12. Another portion was perfectly dissolved in a small quantity of dilute vitriolic acid, with extrication of the well known white and acrid vapors of marine acid.

13. The vitriolic solution, upon the addition of mild vegetable alkali deposited a small flaky precipitate which weighed nearly half a grain, and was readily re-dissolved in vitriolic acid, and acquired the bitter taste of Epsom salt.

From these experiments I was led at first to conclude, according to Bergman, that the $9\frac{1}{2}$ grains dissolved by the alcohol in exp. 2, was muriated magnesia alone; but the remaining portion, which was left in a glass and had deli-

quiesced during the night, was placed near a window exposed to the sun's rays, where it remained neglected for several days. Upon again attending to it I observed several cubical crystals which I separated from the surrounding liquor with the point of a knife, and found them on examination by the taste, the microscope, and different tests, to be very pure crystals of common salt.

14. By repeating the experiment upon the whole quantity of saline matter obtained by alcohol from the residuum of another gallon of water, I collected $2\frac{1}{4}$ grains of common salt in crystals, and thus it appears that the muriate of magnesia contained in a gallon of Hotwell water is only $7\frac{1}{4}$ grains.*

* That alcohol is capable of dissolving a portion of common salt is not, I believe, generally supposed. I have made the experiment on perfectly pure common salt, with the best alcohol I could make or procure, and have always obtained cubes of common salt by evaporating the spirit; altho' I am not yet perfectly certain in what proportion.

15. The $7\frac{1}{4}$ grains which remained after all the cubes of common salt had been removed, was diluted with water, and some nitrated silver dropt in at different times, as long as any precipitate continued to fall. The precipitate was washed with a small quantity of nitric acid, and afterwards with distilled water several times, and the Luna cornea when dried was found to weigh 6.35 grains.

16. The water of Exp. 3 slowly evaporated to dryness afforded very exactly 14 grains of irregular crystals, which attracted a small quantity of moisture from the atmosphere of a damp room.

This salt was divided into four equal parts.

17. A bit of one of those put upon a red hot iron, did not explode nor sensibly decrepitate, but after becoming liquid was converted into a whitish mass, after the manner of Glauber's salt,

which this salt likewise resembles in taste. The taste is distinctly different from that of vitriolated tartar, or common marine salt.

The remainder of this portion was saturated by the help of a blue infusion, with vitriolic acid, of which a very small quantity only was requisite. The fumes of muriatic acid were extricated, and the taste of Glauber's salt became more distinct.

18. Upon another portion of this salt some distilled water was poured, in order to dissolve it; but I found that a small quantity of white matter remained at the bottom undissolved after frequent agitation, and the application of heat; which, upon decanting the solution, was found to weigh about the eighth of a grain. This operation I have since often repeated upon the salts obtained from the water at other times. I find the whole quantity obtainable from a gallon, in this way, to be rather more than half a grain.

It neither effervesces with, nor is soluble in acids, and is undoubtedly nothing but selenite. But why it should have been more readily soluble in Exp. 3 by an equal quantity of water, than now, I cannot easily explain.

19. Into the filtered solution of last Exp. some crystals of saccharine acid were put, which occasioned a small precipitation of saccharated lime that weighed one-eighth of a grain nearly.* This quantity has not varied perceptibly in the different trials I have made, and it can only arise from a portion of selenite dissolved along with the salt. But as the proportion of calcareous earth in selenite and in saccharated lime is nearly the same, we may conclude from this and the foregoing Exp. that about one grain of selenite is contained in the 14 grains of salt under examination.

* I have repeatedly convinced myself by experiments on Epsom salt and muriated magnesia, that saccharine acid does not precipitate the magnesia from them, as has been alledged by some.

20. The filtered solution of this portion of the salts, from which the selenite had thus been separated, was mixed with a solution of alkali of potash, and heated to the boiling point; but no precipitation was perceivable after several hours standing; a proof of the absence of Epsom salt or magnesia in any form, as well as of earth of allum. But as it was rendered probable by the foregoing experiments that some vitriolic salt existed in the compound under examination.

21. Another portion of Exp. 16, from which the selenite had been separated by acid of sugar as above, and dissolved in half an ounce of distilled water, had a few drops of pure muriatic acid dropt into it*. Muriated barytes

* The muriatic acid was added here, in order to prevent the barytes from being precipitated by any uncombined alkaline salt that might possibly exist in the solution: But this precaution was probably unnecessary, as the salts neither alters the colour of Turmeric paper, nor infusion of Brazil wood; a sufficient proof that no alkaline matter is present; nor is any alkali obtained by washing with distilled vinegar.

was then added, which instantly caused a copious precipitation of terra ponderosa, weighing, when washed repeatedly with distilled water, and dried, 4.75 grains; which is at the rate of 19. from the 13 grains of salt under examination, when separated from the grain of selenite they have been shewn to contain.

From the taste, appearance, and habits of these salts, from the rareness of vitriolated tartar in mineral waters, from the evidence of Exp. 20, which proves the absence of Epsom salt, it becomes almost perfectly certain that the vitriolic acid detected in this experiment, is furnished from vitriolated soda, or Glauber's salt. In order, therefore, to ascertain the quantity or relative proportion of the Glauber's salt, I made the following Exp. suggested by Dr. Black in his incomparable analysis of the Iceland waters, from which I have greatly borrowed.

22. Ten grains of Glauber's salt that had spontaneously effloresced into a fine white pow-

der, was dissolved in distilled water. Some infusion of Brazil-wood was added, to see whether the salt was perfectly neutral, and a few drops of muriatic acid afterwards poured in, as in last Exp. Muriated barytes was then added to saturation, and 16.9 grains of terra ponderosa was obtained.

According to this experiment, a gallon of Hotwell water contains 11.24 grains of Glauber's salt.

23. As it appeared from Exp. 18, that a muriatic salt existed in the mixed salt under examination, the remaining portion was dissolved in distilled water, to which a few drops of nitric acid, perfectly pure, was added. Nitrated silver was then poured in, to saturation, and 1.1 grains of luna cornea was precipitated; which is at the rate of 4.4 from the 13 grains.*

* It may be suspected that the vitriolic acid of the Glauber's salt contained in this portion might precipitate part of the silver; but I have repeatedly ascertained the

From an attentive consideration of the preceding experiments, it appears impossible that the muriatic acid thus detected should proceed from any thing but muriated soda or common salt. To ascertain the quantity of this salt in the water, I therefore made the following experiment :

24. Ten grains of common salt that had been purified by repeated crystallization, and perfectly dry, yielded 24 grains of luna cornea by saturation with nitrated silver.

The common salt therefore in a gallon of this water, (including the 2.25 grains of Exp. 14), is 4.05 grains : and the 14 grains dissolved by the cold water in Exp. 3, consists of

Selenite	1 grain
Glauber's Salt .	11.24
Common Salt .	1.8
	14.04

contrary, by experiments made with a much larger proportion of Glauber's salt to the water. The same observation is made by Dr. Black.—Analysis of the Iceland Waters.

There remains to be examined, the contents of the water of Exp. 4, which dissolved $10\frac{1}{2}$ grains of the residuum.

25. This being evaporated to dryness, a thin crust adhered to the sides of the vessel, and shining stellated crystallizations covered the bottom, as in Exp. 1, which, when collected together, was found to weigh $10\frac{1}{2}$ grains. The remaining $\frac{1}{4}$ grain having been lost in the operation.

This substance was perfectly insipid, attracted no humidity from the atmosphere, and gave no tinge to infusion of Brazil wood.

From these characters and the foregoing experiments this should be selenite; but in order to see whether any carbonated lime or magnesia was taken up by the boiling water,

26. Upon the $10\frac{1}{2}$ grains some drops of muriatic acid were let fall, but no effervescence

nor extrication of gas took place. Some distilled water was then added, which was afterwards carried off by a cotton thread, and the powder was found reduced to nine grains.

27. This liquor was divided into two equal parts. One was mixed with lime water; but no deposition of magnesia took place.

28. The other portion was evaporated to dryness, and yielded $\frac{1}{4}$ of a grain of a white powder, that shewed no disposition to deliquesce, which it must have done if it had been muriated lime: neither did it dissolve in a small quantity of muriatic acid, although it was thereby rendered miscible with water; and any acid, even the vitriolic acid produces the same effect. This I found to be a property of selenite as well as of saccharated lime; but I was at first a good deal puzzled with the phenomenon.

According to the foregoing experiments, a wine gallon of 231 cubic inches of Hotwell

water, is impregnated with

Muriated Magnesia $7\frac{1}{4}$ grains

Muriated Soda 4

Vitriolated Soda $11\frac{1}{2}$

Vitriolated Lime $11\frac{1}{2}$

Carbonated Lime $13\frac{1}{2}$

Making together of solid matter, $47\frac{3}{4}$ grains

Carbonic acid gas 30 cubic inches

Respirable air 3

Making together of gaseous }
fluids. } 33 cubic inches.

The following Experiments were made as a check upon the foregoing conclusions.

29. A gallon of Hotwell water was saturated with nitrated silver, (some nitric acid having been previously mixed with the water in order to prevent the precipitation of the silver by the calcareous earth), and 16 grains of luna cornea was collected.

It will be remembered we formerly obtained 6.35 grains of luna cornea from the muriated magnesia of Exp. 14; 5.4 grains from the $2\frac{1}{4}$ grains of common salt of the same Exp. and 4.4 from the common salt of Exp. 24: which added together make 16.3 grains of luna cornea, which is tolerably near.

30. A gallon of Hotwell water, into which some muriatic acid had been previously poured, was saturated with muriated barytes, and 37.8 grains of terra ponderosa was collected.

We formerly obtained 19 grains of terra ponderosa from the Glauber's salt of Exp. 3; but 18.8 grains is still wanting, which was no doubt furnished in last Exp. by the selenite dissolved in the water, which we have found to be $11\frac{3}{4}$ grains. In order, therefore, to determine the relative quantity of vitriolic acid furnished by the selenite,

31. I dissolved 10 grains of native selenite

finely triturated, by boiling it for some minutes in 600 times its weight of distilled water. I afterwards saturated the liquor with muriated barytes; and 16.5 grains of terra ponderosa was obtained. Consequently, 19.38 grains of terra ponderosa is obtainable from the $11\frac{3}{4}$ grains of selenite contained in a gallon of the water; which added to the 19 grains already stated to have been got from the Glauber's salts, makes 38.38 grains of terra ponderosa from the residuum, which is about half a grain more than was obtained from the water.

The small excess of this, as well as of the luna cornea, is easily accounted for by the more concentrated state of the muriatic and vitriolic salts, whereby the precipitants more readily act on them.

32. Apprehensive lest the saline ingredients had suffered some decomposition by the heat employed for the evaporation of the water, I evaporated a gallon by the heat of the sun, and

action of the air alone, by placing the china dish which contained it close to the window of a room facing the south. The evaporation was completed in the course of four or five weeks, and as the room was kept shut during the time, very little dust could have got in. The residuum did not adhere so tenaciously to the sides of the vessel, as when the evaporation is performed by artificial heat; but when dried to the same degree, it was found to weigh 48 grains, which is not materially different; and I obtained the very same result, by subjecting it to the analysis above recited.

33. I next attempted to prove the accuracy of the analysis by synthesis. But here I could not succeed completely, being obliged to employ a much larger quantity of carbonic acid for the suspension of the carbonated lime, than is found in the natural water.

Having first dissolved the selenite by boiling it for some time with the distilled water, I impreg-

nated the water, when cold, with a quantity of carbonic gas, sufficient for the solution of the chalk, and then added the other ingredients. This artificial water tasted acidulous until exposed for some time to the atmosphere, whereby the carbonic acid was dissipated, and some of the chalk precipitated. Of a water so slightly impregnated with sapid matter, we cannot judge by the taste; but I was pleased to find the analysis of this compound deviate but slightly from that of the natural water, and I extracted very nearly the same quantities of the different ingredients I had mixed together.

34. I thus satisfied myself that no decomposition of the ingredients is occasioned by heat, neither in the natural nor artificial water; but I was still at a loss to account for the suspension of $13\frac{1}{2}$ grains of carbonated lime, in water impregnated with no more than 30 cubic inches of carbonic gas, which would hardly suffice for the suspension of half that quantity; and I could not help suspecting that some decompo-

sition of the original ingredients had taken place, owing to the approximation of their particles in consequence of the evaporation of the menstruum.

The superabundant quantity of carbonated lime which is found in many mineral waters, is generally said by chemical writers, to be suspended mechanically; or, in other words, the particles are supposed to be so extremely minute, and their surfaces so greatly extended, that the resistance of the water prevents their descent. This explanation is not altogether satisfactory in theory, nor can it be reduced to practice by human art. Nature however may possess means of accomplishing this which we are unacquainted with, and there are some analogies in favor of the supposition:*. But to me it appears more probable, that part at least,

* Dr. BLACK in his analysis of the Iceland Waters observes, that when silicious earth is suspended in water by previous combination with an alkaline salt, the alkali may be detached, without precipitating the silicious earth.

of this carbonated lime is suspended in the water by other means; or rather, that it existed in the water in another form and combination.†

It was formerly observed, that the water of the Hotwell was supposed to be tainted in some degree, by the river water, at spring tide. Finding that the temperature did not sensibly vary at those times, I was at first inclined to suspect the accuracy of the observation; but I was afterwards fully convinced, by the increased weight of the residuum obtained by evaporating the water, as will appear by the following table, exhibiting the quantity obtained from the water at different states of the tide.

† Since these sheets were sent to the press, I have begun a series of Experiments on this subject, which, so far as they go, appear to countenance the theory of a decomposition; but they are neither sufficiently numerous nor decisive, at present, to merit a recital.

Weight of residuum from a gallon taken at
NEAP TIDE and LOW WATER:

5th Feb. 1797, 47.5 grains

19th ditto 47.75

22d March 47.75

4th May 47.75

2d June 47.75

19th ditto evaporated by the

Sun's heat } 48.

Avarage 47.75

Weight of residuum from a gallon taken at
SPRING TIDE and HIGH WATER.

14th Jan. 1797 51.5 grains

27th Feb. 51.75

15th March 51.75

24th June 51.75

26th July evaporated by the

Sun's heat } 50.5

Avarage 51.2

The difference, which on the average is 3.45 grains, appears to be more or less considerable, according to the height of the tides, being greatest about the equinox, when the spring tides are highest, and when of course the greatest immixtion of the river water may be supposed to take place. On this account, one would naturally expect the additional weight of the residuum to be made up chiefly of sea salt, derived from the brackish water of the river; but this conjecture did not appear to be verified by the analysis, the most perceptible increase being in the vitriolated soda and carbonated lime. Perfect accuracy in such cases, is not easily attained; but this at least is certain, that when the water is wanted in its utmost purity, whether for the purpose of analysis or medicine, it must not be taken during the flow of the tide, particularly about the full and change of the moon.

Before I quit the subject of analysis, it will be expected I should take some notice of the

Warm Spring lately discovered at Clifton. As this water is found in the immediate vicinity of the Hotwell-Spring, and does not materially differ in external characters, the presumption in favor of its being derived from the same source, is certainly strong; and it was not without some surprize, I found any sensible difference by analysis. I have examined it repeatedly by the processes above described, and likewise by a more particular comparative analysis with the Hotwell-Water; and although I have not discovered any ingredient in the one, which does not likewise exist in the other, the difference in the proportions of some of them is sufficiently striking.

The temperature of this water is about 70 degrees. Its specific gravity is 1.0008. The same appearances were produced by mixing these waters with the different reagents; except that a slightly deeper tinge was communicated to infusion of Brazil-wood and syrup of violets, by the water of Sion-spring.*

* Vide Preliminary Experiments.

	Hotwell	Sion Spring
From a gallon of the waters, saturated with lime-water, I obtained a precipitate which weighed	Grains. 43.63	Grains. 34.5
From a gallon that had been previously boiled, saturated with lime-water . . .	4.8	4.5
From a gallon saturated with acid of sugar	25.6	32.
From a gallon saturated with muriated barytes	37.33	45.
From a gallon saturated with nitrated silver	16.	15.25
From a gallon evaporated to dryness, I obtained a residuum which weighed . .	47.75	51.
By the foregoing analysis, this was found to consist of		
Muriated Magnesia	7.25	6.5
Muriated Soda	4.	3.75
Vitriolated Soda	11.25	8.87
Vitriolated Lime	11.75	18.5
Carbonated Lime	13.5	13.
A gallon of the waters is likewise impregnated with		
Carbonic acid gas	Cub. In. 30	Cub. In. 23.18
Atmospheric air	3	3.

The principal difference in the contents of the two waters, consists in the greater quantity of vitriolated lime, and smaller quantity of carbonic gas, in the water of Sion-Spring. The proportion of the other ingredients is likewise somewhat smaller, but in these the difference is less considerable.

The smaller volume of carbonic gas may not improbably be owing to the accumulation of the water in the bottom of the well; whereby a large surface being exposed to the atmosphere, part of the superabundant gas must necessarily escape.

It seems much more difficult to account for the different proportion of selenite, which in the water of Sion-Spring is so considerably greater. Is it owing to the action of the atmosphere, or of sulphuric vapors on the calcareous sides of the shaft, whereby particles of the newly perforated lime stone are corroded, and washed down by the oozing of water

through the fissures of the rock, or the condensation of moisture on its surface? May it be expected to become less impregnated with this adventitious matter, when time has crufted over the shaft in the manner of natural caves and ancient vaults and wells, whereby a defence would be formed againft the action of the atmosphere, and perhaps, the oozing of extraneous moisture prevented?

The reader will recollect that the heat of this water was found by Mr. Green to be 66 degrees only, whereas I have ftated it at 70, which I have afcertained to be its actual temperature, fince part of thefe fheets were printed off. This feeming contradiction is eafily explained. At the time of Mr. Green's obfervation, the fpring was remarkably fcanty, and only trickled down the fides of the fhaft; but foon afterwards it became extremely copious, fuddenly filling the well to the depth of many feet, which renders it probable that another vein of water, of the above temperature, had burft into the fhaft.

PART II.

MEDICAL PROPERTIES

OF THE

HOTWELL-WATER.

THESE, in a general point of view, will be sufficiently obvious to the Medical practitioner, from the foregoing analysis : but as this publication is more likely to fall into the hands of another description of readers, some illustration must be acceptable to them.

The sensible effects of this water when taken into the stomach, are commonly said to be a pleasant sense of warmth in that organ, with increase of strength and vivacity ; sometimes however, it is reported to cause a disagreeable sensation of weight in the stomach,

accompanied at first with slight transitory vertigo ; but in general, it is accounted an exception to other warm waters, in being neither ungrateful to the stomach nor taste. It is hardly necessary to observe, that its effects, for very obvious reasons, are most considerable on the feverish and debilitated.

The secretion of the kidneys is increased by its use, in a much greater degree than could be expected to arise from the water as a simple diluent ; the natural action of the cutaneous vessels is at the same time promoted or restored, particularly where the insensible perspiration has been obstructed by febrile constriction. Hence, its powers in abating hectic heats and flushings, dryness of the skin and thirst, are natural and obvious ; and thus its efficacy in preventing or moderating, in hectic patients, the copious colliquative sweats which necessarily succeed a previous exacerbation of fever, is easily accounted for.

Increase of appetite is one of the most constant effects of this water ; which alone, would render it invaluable, in numberless cases of great debility attended with local inflammation, where the ordinary tonics fail, or do harm.

Its effects upon the primæ viæ, may be easily conjectured from the analysis. The quantity of saline matter is too inconsiderable to counteract the astringent powers of the calcareous earth suspended in it, and costiveness is not unfrequently occasioned by its use ; which, although easily obviated, it might in some cases be dangerous to neglect.

I will not pretend to offer any theory of the *modus agendi* of these waters in the cure of particular disorders, such attempts being generally fanciful and fallacious : neither could they be rendered intelligible to the generality of my readers. I shall therefore proceed to mention a few of the

DISEASES,
IN WHICH THE
HOTWELL-WATERS
ARE RECOMMENDED.

THESE waters have been accounted serviceable in Scrophulous disorders, Dysenteries, and Diarrhœas, long before they had acquired their high reputation in the cure of Consumption and Diabetes.

In cases of Atony, Indigestion, and Loss of Appetite, Obstructions of the Liver, and various disorders commonly denominated Bilious, brought on by irregular living, abuse of strong liquors, long residence in tropical climates, or other causes, these waters are daily employed with the best effect. Such disorders are usually

accompanied with a quick pulse, and tendency to Hectic Fever; and the system, although greatly debilitated, is often so irritable as to render the ordinary tonic medicines totally inadmissible, much as tonics and restoratives may be needed. The avidity with which the Bristol water is drunk in the West India Islands, where the European constitution is frequently in the state I have mentioned, is perhaps, more to be ascribed to its efficacy as a medicine, than its delicacy as a beverage: and I am fully convinced, both from analogy and experience, that Europeans returning from tropical climates in those circumstances, would derive much more benefit from the use of this, than any of those mineral waters, in which iron, or any other active stimulant is an ingredient, whatever their reputation may be.

For more than a century, the Hotwell-water has been celebrated as a remedy for Diabetes; which seems to have arisen from the perfect cure of a Baker of Bristol, of the name of Gugg, in

1680. Diabetes is comparatively a rare disease, and one of the most obstinate ; and the proportion of cures performed by these waters, is highly creditable to their efficacy.*

But the disease for which the Hotwells are chiefly resorted to, is Pulmonary Consumption. It is above a hundred years since they were first brought into notice for the cure of this disorder ; and they have ever since continued to rise in reputation, notwithstanding the many unfortunate patients who daily resort to them in vain.

* It may at first sight appear contradictory, that this water should act both as a Diuretic, and a cure for Diabetes ; but it is nevertheless natural to expect considerable effects in this disorder, from a remedy that acts so decidedly on the kidneys. For although in the healthy and natural state of these organs, the urinary secretion is increased by the use of the water, it is not the less likely that this secretion should be diminished by it in their diseased and unnatural state, where every thing seems inverted. Accordingly we find that the most efficacious remedies in this disorder belong to the Diuretic class.

and the prejudice and unfavorable insinuations arising from disappointed hope. Frequent failure is the necessary consequence of the widely extended celebrity of the waters, whereby crouds of invalids in the most advanced and desperate stages of consumption, are attracted to the place as a last resource, when no expectation of a cure can be rationally indulged, from this or any other remedy.

The commencement of the disorder is often obscure, and its progress in the beginning easily overlooked. From carelessness, indolence, or a sort of fool-hardiness in the patient, the precious moments in which a cure is practicable are wasted at home, perhaps in a situation extremely unfavorable ; and the journey to Bristol is seldom suggested, until it can serve no other purpose than to amuse the sufferings or gratify the impatience of a dying man.

When the patient happens to reside in the more remote parts of the kingdom, the length

of the journey, and the expence attendant on it, are objects of consideration; and those only who are in the most imminent danger are likely to undertake it. In such cases, it is reasonable to expect the event to be unfavorable; but cursory observers will attribute to the inefficacy of the waters, what was only the result of natural and moral causes. Accordingly I am informed, the journey to Bristol is at present, considered in the northern parts of the island, as a forlorn hope. The reason is obvious. Within the last seven or eight years it has occurred to me to know of one consumptive patient, from Scotland, who expired just as the carriage which brought him had reached the door of his lodgings; of another, who died the morning after his arrival; of five or six who died within the week; and I have heard of several more, who did not live to reach the end of their journey.

The histories of many, very many cases from London and other places, are not less summary;

and many of the same description may be supposed to have escaped my observation.

Surely no reasonable man will adduce the event of such cases as those to the discredit of Clifton or its Waters ! But it is from such cases the opinion of unreflecting people is formed on the subject. Were the circumstances fully known to them, they would draw a very different conclusion. Such cases, where the disease has advanced so near to its termination, are not to be cured by this, nor any remedy hitherto discovered : But the utility of a journey to the Hotwells, undertaken while a cure is yet practicable, is demonstrated by hundreds of examples annually ; where the disease is totally removed or prevented in many, and suspended or mitigated in others.

It is not my intention to insinuate that all those patients would have recovered, had they been brought to the Hotwells from the very first moment of their seizure. The fatal

nature of the disorder will not allow of such presumption. I only mean to set the matter in its true light. Be the Hotwell-waters inert or efficacious, cases like those, fairly stated, can neither attach to them credit nor disrepute.

Of the TIMES and SEASONS for drinking the Waters, and other circumstances to be attended to, by Invalids.

No preparation is necessary except an ordinary attention to the state of the body, which may be regulated by the most common and simple means, and should never be neglected.

The best time for drinking the waters, is before breakfast, when it can be done with propriety. The state of the weather must sometimes render this difficult and improper in winter; but in summer it ought always to be attempted.

Early rising, of itself, is attended with many advantages to Hectical patients. The debilitating morning sweats are thereby avoided, and the not less debilitating effects of second sleeps and dosing, which are sensibly felt even by those in the most perfect health. Next to temperance, early rising is the surest road to health and longevity, as well as to affluence. The victims of a contrary practice are no where more sadly conspicuous than in this place. Warmth being a primary consideration with the consumptive patient, the time of drinking the water is almost entirely restricted to the middle of the day in winter; but in mild summer weather it ought to be repeated between the hours of five and seven in the evening, when it will be found of great efficacy in abating the Hectic Exacerbation, which is at that time more troublesome than at any other.

The quantity to be drunk at a time must depend upon the state of the patient. The glasses at the pump-room contain respectively,

one half, one third, and one quarter of a pint. It might be well to begin with a couple of the smallest size, interposing a short walk or ride between them; but I have frequently known two of the largest taken, three, or even four times a day, with seeming advantage. It is evidently safest to begin with a small quantity, which may be increased according to its effects.

For many years, the Hotwells have been chiefly resorted to in summer, which is undoubtedly the most convenient season for drinking the waters, when that is the only object in view; as it can then be done more regularly, and with less interruption from the weather. The waters may likewise be then more fully seconded by the salutary exercise of riding, over the various downs in the neighbourhood; which, for picturesque beauty, exceed any thing this country can boast of.

But Invalids threatened with Consumption, ought not to wait the return of summer; as the greatest benefit might be derived from passing the winter in a mild atmosphere, at the commencement of the disorder, and the greatest mischief prevented: for the patient, by remaining in a cold easterly exposure through the winter and spring, is not unfrequently rendered incurable, before he reaches Bristol in summer. In our cold and variable climate, the exciting cause of Consumption is most commonly a Cold or Catarrh, from the sharp easterly winds which prevail in the spring and winter months; a warm sheltered situation during that part of the year, is therefore an object of the greatest importance to people predisposed to the disease, or threatened with it; particularly those who reside on the eastern part of the island, where these winds are much more severely felt. To persons so circumstanced, a timely change of residence would often be the means of entirely preventing the impending disorder: which leads me to the consideration

*Of the Hotwells as a WINTER RETREAT for
Invalids.*

From the inspection of its Geographical and Topographical situation, no place in England can be supposed better adapted for this purpose, than the Hotwells. Close to a navigable river, within four miles of that extensive bay of the sea, called the Bristol channel, into which the Severn and Avon discharge themselves, and more than a hundred miles from the open and boisterous ocean, it necessarily possesses all the advantages of a maritime situation, without the disadvantages; the mildness of sea air, with an exemption from storms and tempests.

The adjacent country is admirably calculated to render this spot warm and salubrious. A ridge of high ground in the form of an amphitheatre encompasses that part of Clifton called the Hotwells, on the east, north, and west, sheltering it completely from every wind blow.

ing in those directions. The south wind, which alone can reach this spot, is necessarily mild ; and the rays of the meridian sun, unobstructed by any intervening height, and reflected by the figure of the back ground, renders its temperature in winter almost equal to that of the south of France. Snow seldom lies here, and the frost is never severe : indeed I have known the winter pass without any frost or snow whatsoever.* The same observations do not altogether apply to that part of the parish called Clifton-hill, which being more than 200 feet higher than the Hotwells, must be proportionably colder, independant of its exposure to the north and east winds. From its pure air and fine prospect,

This was the case in the winter 1789—90. The succeeding winter some snow fell, but none lay on the ground a single day : and the following year produced only six or eight days of very moderate frost. I have more than once had occasion to observe during those years, that the snow lay to some thickness on the streets of Bath (which is only 14 miles eastward) and on all the adjacent ground, when not a particle was to be found at the Hotwells.

this is at all seasons an eligible residence for those in health ; but its elevated and exposed situation, render it extremely improper as a winter retreat, for the Consumptive invalid. Its advantages in summer, are, however, manifest and striking. Excessive heat is not less prejudicial in phthical cases than cold itself, particularly in the advanced stages of the disorder ; and I have sometimes observed the air of the Hotwells injuriously warm in hot summers. In such cases, the greatest benefit is obtained from the clear atmosphere of Clifton hill, or any hilly country, such as Wales ; or sometimes, from the cool and refreshing breezes of the sea shore.

Numberless situations are to be found, which might serve as a summer residence for people in those circumstances ; but I know of none in any way comparable to the Hotwells as a winter retreat : and the adjoining buildings on Clifton hill, are disposed in such a manner, that within the distance of a few hundred yards, the best

situation may be found for every season of the year. When to these advantages we add the excellent lodgings, the habitual attention in all descriptions of people to the accommodation of invalids, the vicinity of the large and opulent City of Bristol, where the various necessaries for the sick, can be readily procured; when all these circumstances are duly considered, I trust I am warranted in asserting that no place in England combines so many advantages, independant of the water, nor presents upon the whole such an eligible winter residence for the delicate and consumptive.*

* There are still wanting a few improvements, which naturally suggest themselves here, and which I shall take the liberty of mentioning. 1. A *public Garden*, Clifton being bare of trees, and destitute of shade in hot weather. The piece of ground adjoining the Mall, seems well calculated for the purpose; or that part of the common, facing Sion-row. 2. A *commodious set of Baths*, so essential to the cure of many diseases, and so much overlooked in this country in general. This might be economically established at Sion-spring, as the warm water could be

Notwithstanding these superior advantages, various places on the coast of Devonshire and Cornwall have been of late recommended in preference to the Hotwells, particularly by Physicians in the northern parts of the Island.

supplied from the steam engine, almost without expence. Here is already one which serves alternately as a warm and cold bath. Such a place as Clifton would certainly reward the projector for something of greater elegance. 3. It is to be regretted, there are not under the hill more houses of a proper size for *single families*; most of the lodging houses there being on a large scale, sufficient to accommodate three or four, which necessarily renders them noisy and incommodious, in some respects, for the sick. Cornwallis Crescent appears admirably calculated for the purpose, and the houses, when finished, will possess every advantage, both in point of size and situation. 4. All the roads from Clifton to the Wells are *too steep*; and often, although perhaps without much reason, terrify invalids who have not been accustomed to hilly countries. This inconvenience would, in a great measure, be obviated by the completion of a road projected and begun some years ago, by the back of Prince's Place; which might be done by subscription. 5. A *Bridge over the Avon* would be an immense improvement to the country in general, and to the Hotwells as a watering place, by opening to the Invalid, the beautiful and sheltered roads through the vale of

This preference seems to have arisen from attending simply to the latitude of the places, without paying sufficient regard to local circumstances. The coast alluded to being about a degree farther south than Bristol, will naturally enough be expected, upon a superficial glance, to be proportionally warmer; but a moment's consideration must serve to convince, that latitude alone does not regulate the temperature of places. I have never been able to obtain a complete register of the weather at

Ashton, from which they are at present morally excluded by an execrable ferry. The Colossal bridge so often talked of, which was to have connected St. Vincent's rocks, we must not expect ever to see erected. Yet, what a fine opportunity this, for a man of overgrown fortune to transmit his name with honor to posterity, upon such a majestic and useful monument of his splendor and munificence!

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Those who are desirous of knowing farther particulars of the history of the Hotwells, and the opinions of Physicians on the virtues of its waters, may consult the treatises of Drs. Randolph and Sutherland, or a late publication on the subject, by Dr. Nott.

any of the places alluded to : but such accounts of the Barometer, Hygrometer, and even of the Thermometer, as have come to my knowledge, by no means warrant the exclusive reputation they have acquired at a distance.

From the maritime, and almost insular situation of Cornwall, and its vicinity to the western ocean, we are naturally led to expect a moist atmosphere, frequent fogs, damp houses, much rain, and boisterous winds ; and accordingly these inconveniences are the general subjects of complaint, by the inhabitants as well as strangers. The atmosphere near the sea shore, particularly in windy weather, is impregnated with saline particles to a great degree ; which is generally hurtful to the consumptive, by irritating the tender lungs, and provoking cough. I am aware there are some exceptions to this rule ; cases sometimes occurring, in which it appears at least to do no harm. Yet I am disposed to believe these exceptions to be much fewer than is generally supposed. There are other diseases,



which, having many symptoms in common with consumption, are often mistaken for it; yet are, in their nature very different, and to be cured by the most opposite means: and most of the cases of this sort of (supposed) consumption that have occurred to my observation, wherein the saline atmosphere had been beneficial, appeared to be cases of chlorosis, or mesenteric tabes, attended with hectic, and mistaken for Phthisis; but without any actual inflammation of the lungs. Wherever the real Phthisical inflammation existed, I have almost uniformly observed an aggravation of the cough and hectic fever, upon approaching the sea in windy weather. In summer, or in calm weather, when the saline atmosphere is scarcely perceptible, this observation will not hold good. Much advantage has been derived from a long voyage in a calm sea, such as the Mediterranean; but the benefit here may be supposed chiefly to arise from the exercise of gestation, and not from sea air. It is in this place likewise proper to observe, that the atmosphere at sea, except,

perhaps, in a storm, is much less impregnated with moisture and saline particles, than that of the sea coast, for very obvious reasons.

In addition to the objections already mentioned, it behoves the admirers of Devonshire and Cornwall, to consider the inferiority of accommodation for Invalids in those places, which is often a more important consideration than climate itself. A damp, uncomfortable apartment, is an evil to such persons, which no temperature can compensate.

As water must necessarily be the principal beverage of Phthical Invalids, it is worthy of remark, that the water of the wells in most of the towns along that coast, is more or less impregnated with salt; which of itself is a great inconvenience; and as those towns are generally destitute of level ground in their neighbourhood, the patient must be in a great measure deprived of the salutary exercise of riding; a loss which cannot be compensated in winter by sailing,



except to those whose health and strength are very little impaired.

Many other arguments suggest themselves on this subject; but I may be thought to have already enlarged much farther than was necessary to produce conviction, of the superiority of the Hotwells, as a winter retreat for consumptive invalids. I shall therefore conclude by repeating my admonition to those who design to avail themselves of the aid of the Hotwells, not to await the return of summer, but repair to them in winter or autumn; prevention being easier than cure. There are few cases of Phthisis, unless the predisposition to it is unusually strong, where the disorder might not be warded off by proper means early applied: but there is no time to be lost; what to-day appears only a catarrh, or a slight irritation of the bronchial tubes, and which might be cured by a single bleeding, may in the course of a few winter months, or perhaps a single week, if neglected or flimsily treated, have grown

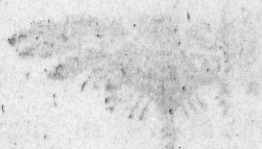
into a confirmed consumption, beyond the reach  
of medicine.





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into a continued confusion, he said the  
of the



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*Practical Observations*  
ON THE  
PREVENTION AND TREATMENT  
OF  
PULMONARY CONSUMPTION.

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PHTHISIS PULMONALIS or Pulmonary Consumption, being the disease for which the Hotwells are chiefly resorted to, a few observations on this formidable and increasing malady, seem intimately connected with the foregoing subject. What I have to offer, being principally addressed to those readers who have not made physic their study, little will be found in it to interest the physician, or to gratify the prevalent thirst for novelty in medicine : The public may however, reap some advantage from the following remarks and



cautions ; which I shall endeavour to render the more easily intelligible, by avoiding as much as possible, the use of technical terms and physiological controversy.

Pulmonary Consumption is an ulceration of the lungs, of a particular kind, and is known by a combination of most of the following symptoms : pain in the chest, cough, purulent expectoration, with hectic fever.

This disease is incident to persons at every time of life ; but is supposed to commence most frequently about the age of puberty, particularly in females ; who indeed, appear more liable to it at every age than males. The children of Consumptive or Scrophulous parents are much more frequently its victims than others ; particularly those of fair florid complexion, delicate smooth skin, with large veins, light hair, blue eyes, slender make, and narrow chest. Consumption is an epicure as well as a glutton ; and it is a humiliating re-

flection that beauty should be often so nearly allied to disease. This disorder usually commences with a slight cough, at first hardly distinguishable from the ordinary catarrhal cough, commonly dry in the beginning, but sometimes attended with a mucous expectoration streaked with blood. This is accompanied with pain in some part of the chest, and slight uneasiness in breathing, frequent chills and flushings, which afterwards come on pretty regularly between the hours of three and seven in the evening, and in many cases, likewise about ten in the morning attended with frequent pulse,\* morning sweats, loss of strength and flesh, expectoration of a yellowish pus mixed with the mucus

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\* This double exacerbation and remission is considered as the distinctive character of hectic fever. I doubt not the reality of the distinction. Perhaps, did not some circumstance, to us unknown, derange the operations of the febrile power, it would be uniformly so. But as the matter actually stands, the double exacerbation does not regularly take place in one out of three cases of phthisis, in any of its stages. The exacerbation generally begins from three to seven o'clock in the afternoon, and continues,



of the throat and saliva, and commonly diarrhœa towards the end of the disorder. In the beginning the pulse is frequent and hard during the exacerbations; but during the remissions it returns in many cases to nearly the usual standard. In the advanced stages the pulsations are generally frequent, quick and feeble, and the remissions less perceptible. The blood when drawn shews from the first every mark of inflammatory affection, and continues to do so to the end. The urine is at first high coloured, afterwards turbid, and depositing quickly a copious brick-dust like sediment: towards the conclusion it

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through its chilly, hot, and sweating stages, until about five or six next morning; after which there is a remission until about the same hour in the afternoon. Instead of a single cold and hot fit succeeding each other and lasting a considerable time, the hectic exacerbation consists of many chills and flushes of short duration, alternating quickly: afterwards warmth or heat becomes more uniform, and at length perspiration breaks out, often cold and partial. The clean tongue, contrary to what takes place in other fevers, is one of the most uniform marks of hectic. The sediment in the urine may be sometimes prevented by various medicines.

is scanty, owing probably to the copious perspiration and diarrhoea which generally take place. The tongue from the first is but slightly furred, and during the progress becomes remarkably clean and glossy. Thirst is not very considerable, and the appetite is often but little impaired. Expectoration, of a purulent appearance, is generally an early symptom, but in some cases it takes place only a short time previous to the fatal catastrophe, and long subsequent to the hectic fever, emaciation, and other characteristic symptoms of the disorder. Varieties of this sort are naturally to be expected from varieties of constitution and accidental circumstances. These symptoms commence for the most part in winter or spring, and sometimes disappear almost entirely during the warm weather of summer, but return again with the winter's cold; and this alternate intermission and relapse continue not unfrequently during several successive years.



Such is the history of Phthisis in its usual form : and by a careful attention to the symptoms described, together with some particulars to be afterwards mentioned, the disease may in general be easily detected in its very early stages.

I shall now proceed to consider the remote or predisposing causes of the disorder, which will at the same time comprehend an inquiry into the causes of its greater frequency in this than in other countries.

Phthisis is said to originate either in predisposition; or accidental injuries done to the lungs, or, as frequently happens, in both together. Predisposition strictly speaking may be either hereditary, or acquired during the course of a person's life from certain conspiring causes, without any original taint. By hereditary predisposition, is meant that similarity in the structure of the lungs, or of the containing parts of the chest, to those of the consumptive parent

which either constitutes the (latent) disease itself, or renders the person more easily affected than others by the ordinary exciting causes.\* Accordingly it is demonstrated by Anatomical researches, that the lungs of children of con-

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\* An objection is made by some, to the term *hereditary*, applied to diseases, because they cannot easily comprehend how a disease could be transmitted *substantially* from parent to child in embryo: But it surely is not mere a matter of surprise that the child of a consumptive parent should inherit that *internal* similarity of lungs we have mentioned, giving rise to the disorder, than that he should inherit an *external* similarity of shape features or colour of hair. We are equally ignorant of the manner in which this is effected, in both cases. But as the superior proneness to the disease in such persons is not to be questioned, it has been supposed to proceed from debility alone. That debility frequently *accompanies* this predisposition is certain; but this is not always the case: On the contrary the predisposition is sometimes most obvious in persons otherwise remarkably strong and robust. A *general debility of constitution* therefore cannot be the cause of this proneness to consumption in the children of consumptive parents; and supposing it to be a *local and specific debility*, it is, nevertheless, hereditary; and the term *hereditary predisposition*, appears to me to express the fact better than any other.



sumptive parents, (as well as those of the parents themselves), are commonly replete with small callous opaque bodies called Tubercles, which in the dormant state, or early stages, are scarcely the size of millet seeds, and solid; but afterwards enlarge to the size of a pea, becoming inflamed, hollow, and filled with a yellowish viscid matter, which at last forces its way through its capsule, into the air cells of the lungs and ramifications of the windpipe, and is thus expectorated by coughing. The disease is then called confirmed consumption; previously, it is termed incipient or threatening consumption. During the process of enlargement of these tubercles, a considerable inflammation generally takes place in them, and the parts of the lungs adjacent, occasioning some degree of pain, or sense of heat, with frequent cough, and sometimes spitting of blood from the erosion of the minute arteries. Whether phthifical hæmoptysis, or that spitting of blood which is followed by consumption, takes place only in persons whose lungs were previously

affected with tubercles, and proceeds only from the cause we have just mentioned, is not absolutely certain; but it is rendered extremely probable from the circumstance of tubercles being always found in the lungs of persons who have died of consumption following hæmoptysis. It is likewise observable that when a spitting of blood is brought on by accidental violence, in persons entitled to the tubercular predisposition, it is most commonly followed by consumption; whereas those who are not so predisposed generally escape unhurt from similar accidents, the ruptured vessel healing up, as in other parts of the body. I do not mean to insinuate that the accidental rupture of a blood vessel in lungs otherwise sound, is incapable of producing the phthifical ulceration. Cases of this sort are supposed to occur; but they are comparatively rare. The same observation holds good with respect to inflammation of the lungs from other causes, such as catarrh, measles, and pneumonia, or from wounds of that organ by ex-



traneous substances; the danger of consumption being always in proportion to the degree of predisposition.

Although the hereditary predisposition is by far the most common remote cause of the disorder, it would appear that a predisposition to it may likewise be acquired during the course of life, by the action of certain causes, where there is no reason to suspect an hereditary taint. Do these causes act by producing tubercles in the lungs? This is not directly proved by such persons falling victims to consumption; but it is rendered highly probable by the fatal inheritance being likewise transmitted to their offspring.

Thus we frequently find consumption commencing its baleful career in families where hereditary predisposition cannot be traced, and continuing through several generations. It must however be acknowledged that considerable ambiguity rests upon this subject; for it cannot

be absolutely demonstrated that tubercles did not originally exist in such families, however improbable it may be in many cases. Indeed every thing relative to the nature and origin of tubercles is at present involved in much obscurity. By some they are supposed to be of a glandular nature, obstructed or schirrous; and this conjecture, although liable to some objections, is not destitute of great plausibility.

Whatever they are, it is sufficiently probable that they may be produced, or rendered obvious to the senses, by the action of certain causes, without any hereditary taint : When once produced in the lungs of a person by such causes, the children of that person will inherit a similar structure of lungs, will inherit tubercles, or at least, a much greater propensity or proneness to the acquirement of them than usual ; for it is not absolutely determined whether the tubercles are visible in such children from the time of birth, whether they become so spontaneously, or only in consequence of the action of exciting causes : Tubercles when acted upon to a certain degree



by exciting causes, inflame, undergo a kind of suppuration, and become consumptive ulcers : Where the tubercular predisposition is strong, a comparatively slight action of the exciting causes will be sufficient to produce consumption : Where from the habits of a person's life, the influence of the predisposing causes is superadded to hereditary predisposition, the danger is greatest : The surest way of escaping the disease, where hereditary predisposition exists, is to avoid with care not only the exciting causes, but likewise those habits of life and other circumstances, which act as predisposing causes. Some of these I shall now endeavour to point out, being a principal part of the preventative treatment ; but the reader will make allowance for the great difficulty as well as uncertainty attendant on such investigations.

The greater frequency of consumption in this, than in other countries, has been generally ascribed by authors, to an insular situation, and a cold and variable climate.

That those circumstances have considerable influence on the frequency in question, by acting as almost constant exciting causes, I have not a doubt ; but still their influence appears insufficient to account for the whole effect. For although there are other insular and maritime countries where the climate is as cold and the weather as variable ; yet in none of those do we find consumption by many degrees so frequent. I am therefore inclined to suspect that we must principally look into our national habits, and manner of living, for the solution of the mystery.

I believe it is universally agreed that in no European nation is the use of animal food so general through all ranks of people ; indeed in no other nation, Holland perhaps excepted, are the lower orders capable of purchasing it in such abundance ; a smaller proportion of vegetable matter of course enters into the diet of the English ; which is, therefore more nutritious, and, in common language, more heating and



inflammatory, than that of other nations. The natural consequence of this sort of diet, is a greater degree of irritability in the muscular fibre, and a fullness of blood beyond the standard of health, rendering them more susceptible of inflammatory affections, and constituting what is called an inflammatory diathesis. The use of strong fermented and spirituous liquors, is likewise more general, which may co-operate with the stimulant diet, in occasioning the inflammatory diathesis alluded to.

That full diet or strong liquors, are not propitious to health, is in general certain; although some particular exceptions may exist. I have invariably observed the water drinkers, amongst the higher ranks (I mean those, who from choice, drink no stronger liquid) to enjoy the best health and the clearest intellect; and those nations which are least addicted to the pleasures of the table, will be found, *cæteris paribus*, the freest from disease. In confirmation of this doctrine I might cite the Hindoos, the most temperate,

and the most healthy of men. Even the French and Italians are certainly less affected with an eternal catalogue of diseases than the English. They are a hardier and healthier people, through all ranks. Both these nations are more abstemious. I speak of them as they were. In France, drunkenness was comparatively rare; in Italy, a person in a state of intoxication was, in the streets at least, a very unusual sight. Were we to abandon the so very general use, or rather abuse of wine and other strong liquors, a very great proportion of diseases, which detract so much from the comforts of polished life and affluent circumstances, would speedily disappear. Men's ideas are commonly very erroneous with respect to the abuse of strong liquors. That abuse begins much within the limits of intoxication. In the higher ranks, he who drinks one bottle only, reputes himself a sober man; and he who does not exceed half that quantity daily, is considered as remarkably temperate. But although either of these allowances may be often persisted in for some years with seeming



impunity, there are few indeed, of those men of iron, whose constitution will not be undermined at last, by this regular and constant siege. It were better, for young men at least, so far as health only is concerned, and abstractedly from considerations of morality, to get drunk once a week, and abstain entirely the other six days, than regularly to indulge in what may be called a moderate allowance, of Port, or Maderia, or other strong wines, every day. In the first case there would be time for the vinous fever to subside entirely, and for the constitution to regain its wonted tone; but in the latter case there is no intermission. The system is kept continually in a state of unnatural excitement, which hardly any strength of stamina is long capable of bearing up against. Hence the almost uniform conclusion: Gout, Stone, Jaundice, Dropsy, Palsy, Apoplexy, Mania, Consumption: with the bequest of such diseases, together with a general feebleness of body and often of mind, to their ill-fated offspring. These are the fatal effects of the Promethean

fire. It is not to be understood from hence that wine is not useful as a medicine or a cordial, particularly in the decline of life; although the celebrated Cornaro, and many others, have given proofs of its being unnecessary, even at the most advanced age. But however congenial or salutary wine may prove to the languid nerves of the aged, it must always be pernicious to the young and inflammatory fibre. Were men to drink water only, or small beer, while young and vigorous, the moderate use of wine would probably add both to the comfort and duration of that old age, which they by this means might expect to attain.

But the abuse of wine does not always originate in social intercourse and youthful folly. In the present day, the mother, afraid as it would seem, lest her darling child should retain any portion of vulgar health, carefully initiates him into the mysteries of Bacchus, from the very cradle; and as soon, almost, as little master is capable of swallowing, he is indulged with



his regular allowance of wine. No wonder that Gout, Dropsy, Schirrous Liver, &c. should make such a conspicuous figure in the history of his " life and sufferings." From this early initiation into unnatural and luxurious habits, the native vigor of the best stamina must soon be worn out by premature exertion ; and if the child is lucky enough to escape the violence of accidental colds and eruptive fevers, he will quickly fall a prey to diseases of the Asthenic class, and find himself an old man in constitution, while he is yet a boy in years.

Children, being endowed with extreme irritability of fibre, are exceedingly prone to inflammatory disorders upon the application of stimulating powers, even of the weakest order. In such circumstances, neither rich food nor strong liquors can, generally speaking, be at all admissible ; and the effects of the practice become quickly visible on the children of the rich by the train of inflammatory diseases to which

they are subject.\* But on the contrary, where fashion and luxury have not yet banished nature and reason from the nursery, where animal food is sparingly administered, and strong liquors not at all, a numerous race of blooming and healthy children grow up into a hardy manhood, which by temperance, may be lengthened out to a chearful old age, exempt from its usual infirmities. Milk and farinaceous vegetables afford the best, and only proper nourishment for children under three or four years of age, and they ought to form the principal part of their diet for seven or eight years after. But it may be alledged that in cases where the stamina are originally weak, as in children of consumptive parents, a more generous regimen is indicated in order to strengthen them to the common standard : and accordingly I have known animal

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\* On this subject see Downman's admirable poem, *INFANCY*; which ought to be carefully studied by every nurse and every mother.



food and wine prescribed with this view in very early infancy. But if the stamina are weaker than usual, this is the best reason why the small portion of vigor that exists, should not be prematurely worn out by such unnatural stimuli; for surely that is not the kind of food prescribed by nature for this stage of existence. In such circumstances, a proportionably more bland and simple nutriment seems to be indicated. If rich food, in large quantity, could at any period of life impart strength and hardiness, the affluent must always be strong and healthy. The reverse is notoriously true. A certain quantity only, of nutrition is necessary, to supply the waste of strength occasioned by voluntary and involuntary action. The quantity requisite may indeed vary a little according to the degree of exertion, or other circumstances: But the rich seldom stop here, and the superfluous quantity of aliment serves only to generate and nourish disease; and thus, the rich and affluent are brought again upon a level with the poor, when the

balance between suffering and enjoyment is fairly struck.

It is not always in the power of a parent to restrain young men, when launched into the world, from the abuse of wine ; but they will surely be the better able to resist the force of the poison, for having been preserved untainted for twelve or fifteen years.

Against this doctrine it may be urged, that young women of good condition, who often eat very sparingly of animal food, and drink but little wine, are frequently still less healthy than their dissipated brothers. To estimate rightly the force of this objection, we ought to take into consideration, not only the original stamina of the persons, which alone would often afford a sufficient solution of the problem ; but also the female manner of living, which, notwithstanding their abstemiousness, is still more distant, if possible, from nature's dictates. Without exercise, and even labor, the human



body cannot long preserve its healthy action ; but exercise and labor can be but sparingly and insufficiently employed by a lady, particularly in towns, without a breach of delicacy and decorum. On the contrary, the sedentary, inactive, formal life, they are morally compelled to lead, the unnatural hours of rest, the want of mental energy, arising from the want of pressing and invigorating pursuits, and the general restraint which the maxims of polished nations necessarily impose, all tend to cripple and enfeeble their vital powers, and to render them, like flowers raised under cover, incapable of contending with the inclemency of the atmosphere. This is an evil, attendant on riches and civilization, which it appears difficult, and perhaps impossible to remedy, so great must be the change in national manners and habits : But it is in the power of every parent to obviate, in some degree, the evils alluded to, so far as respects his own family.

It would carry me beyond the scope and limits of my plan, to enter fully upon the defects of modern school education, so far as it respects the health of the youth of both sexes: But I cannot help observing, that a considerable share of the delicate constitution we have been speaking of, is attributable to this cause. From almost continual motion, arises the pleasure and the health of childhood: How unnatural then, to send a child of four years of age to be immured in a suffocating school-room, and chained to a bench half the day, merely to be out of harm's way. I have seldom seen a boy more advanced in his education at the age of seventeen, for having been sent to school before the age of eight or ten. If during the first ten years of life, he has been taught to acquire a strong and hardy constitution, it is of infinitely greater consequence than the few grammar rules that might have been whipt into his reluctant memory.



Cloathing may well be considered as an agent in the production, as well as in the cure of diseases ; and is therefore deserving of notice in this place. It is generally remarked by foreigners, that we are much less attentive than the people of other nations, in adapting our cloathing to the temperature of the weather, climate, and season ; a circumstance for which no good reason can be assigned. The more frequent vicissitudes of weather in our island, must indeed render this observance more troublesome ; but it renders it, at the same time, more necessary. I have been informed, that the Chinese not only vary their cloathing with the season of the year, but also with the hour of the day.

The quality of the cloathing must likewise possess considerable influence on the health. In modern Europe, a preference is universally given to linen, as an immediate covering for the skin, on account of its superior elegance and cleanliness ; but in many respects it is, perhaps, better adapted to the latitude of Egypt, whence

it originally came, than the cold regions of the North. Although woollen is less agreeable to the eye, and perhaps less pleasant to the skin, the difficulty with which it suffers either cold or heat to pass, gives it a decided superiority as an article of cloathing, in such a variable climate as ours. From the accounts that have come down to us of the ancients, particularly the Romans, they appear to have been a much healthier and hardier people than the modern Europeans. It must be confessed it is not now easy to ascertain the general state of health in their towns and villages ; but were we to estimate it from that of their armies, concerning which our information is more conclusive, we should be induced to believe that diseases, barring accidental visits of the plague, were much less frequent than with us. In the best regulated modern armies, almost one third perish in the course of a campaign, by disease and fatigue alone. Amongst the Romans no such proportion was allotted to this ignoble death. But the Romans wore no linen. and the superior



advantages of woollen shirts for those who must necessarily be exposed to every change of weather are so apparent, that I have been often inclined to attribute a considerable share of the superior healthiness of their soldiers, to this article of their cloathing. This opinion seems to be confirmed by the experience of thousands, who of late years, have adopted the practice; and the use of flannel next the skin, is likely to become again very prevalent. This subject is extremely interesting to statesmen and generals, as well as to individuals.

Not only the materials, but likewise the form of dress, may possess considerable influence over the health. The grand *desideratum* in dress, is elegance combined with utility; and perhaps all our ideas of the former, are ultimately derived from experience of the latter. Measured by this standard, the present *costume* of the men must rank very low indeed; where neither elegance nor fitness have any part: an instance of the triumph of capricious and exotic fashion, over

the laws of taste, and the dictates of nature. But abstractedly from ideas of taste, every thing tight in dress, by compressing the parts and cramping motion, is injurious to health. I have more than once observed a temporary spitting of blood excited by wearing the waistcoat too narrow, or by buttoning the coat over the chest. But the injury to the female sex from the use of long and strait stays *was* much more serious and extensive. The mischievous effects of this absurd and unnatural fashion on the tender frames of young women, could only be equalled by its own innate deformity ; and it is to be hoped, that long waists will never again disfigure the persons of our fair country women. The loose Grecian dress of the present day is not less conducive to health than to elegance ; and although it is not long since the waist has escaped from bondage, a sensible improvement in health and beauty, will, I doubt not, soon be apparent.

While engaged in considering the influence



of dress on the health, I am led to notice the practice at present very general amongst Ladies, of *occasionally* covering the throat with a cravat, while perhaps, a considerable part of the chest is left exposed to the inclemency of the weather. The subject may appear trivial to some ; but as this *inverted* custom is not less injurious to health than detractive to beauty, I deem it not unworthy of disapprobation.

I have thus endeavoured to point out the most considerable remote causes of this disorder, together with those circumstances in our national manners and habits which most obviously contribute to produce that tenderness and irritability of constitution, which renders the inhabitants of this country more liable to disease in general, and to consumption in particular, than the neighbouring nations.\* But the disorder is never

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\* Various other circumstances which I have not enumerated, have likewise been supposed to contribute thereto ; such as the very general use of Tea during the present century ; open chimneys, and fires of pit coal ; even the

supposed to arise spontaneously ; being always traced by the patient to some accidental injury, while the predisposition is frequently overlooked. The circumstances which are thus immediately instrumental in rousing the disease into action, are denominated *exciting causes*.

These are injuries done to the lungs, by extraneous substances, by falls, bruises, and violent exercise, superinducing inflammation or hæmoptysis, various eruptive disorders, Pneumonia, Catarrh, &c. The operation of most of these agents in the production of consumption, is too apparent to require any comment. Pneumonic inflammation is of two kinds, as it affects the substance of the lungs or the investing membranes, and thence called Peripneumony or Pleurisy. The former terminates either in

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increased size, cleanliness, and comfort of modern houses and apartments, by affording a more plentiful supply of pure air, has been supposed to render the lungs more susceptible of the consumptive inflammation.



resolution, in death, or in suppuration of the ordinary kind. This sort of pulmonary abscess is always followed by hectic fever and cough, but not always by consumption. For the matter of the abscess sometimes bursts into the cavity of the chest, whence it may be either absorbed or evacuated by a surgical operation : at other times it finds its way into the bronchial tubes, and unless suffocation instantly ensue, it may be expectorated, and the patient recover : not unfrequently, however, particularly where the phthical predisposition exists, it terminates with all the usual symptoms of consumption.

The terminations of pleurisy are nearly the same with those of peripneumony, and indeed the two varieties of the disorder are usually combined : but where the pleura happens to be principally affected, instead of resolution or abscess, an effusion of water into the cavity of the chest sometimes takes place ; or adhesions are formed between the two contiguous surfaces

of the pleura, giving rise to cough, dyspnœa, and frequently consumptive ulceration, with its usual symptoms.

There is likewise a species of inflammation of the pleura, arising without any evident cause, which differs from pleurisy in not being attended with violent pain, fever and dyspnœa, and seems to have the same relation to that disorder which chronic rheumatism has to the acute. In consequence of this, adhesions frequently take place, which sometimes lose by degrees their inflammatory tendency, and remain for many years without occasioning much inconvenience; except perhaps a transient pain upon any uncommon exertion, with some dry cough and dyspnœa upon exposure to cold. At other times, however, the adhesions are followed by ulcerations spreading through the substance of the lungs, and producing all the usual phenomena of phthisis. In other cases, the adhesions between the two surfaces are not so complete as to render them perfectly continuous, but



sometender filamentous granulations are formed, connecting the membranes loosely together. These are probably stretched and injured by the motion of respiration, or efforts in coughing, whereby a serous fluid oozes out continually into the cavity of thorax, the accumulation of which constitutes dropy of the chest.\*

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\* I remember to have seen a case of this sort which was said to commence with the usual symptoms of incipient Phthisis, nor was the real nature of the disorder for a long time suspected by some very able and experienced Physicians. After death, the cavity of the chest was found to be filled with water, the lungs being compressed into the size of a man's fist; but they were easily inflated to the natural size, and were perfectly sound in every part, except about the breadth of half a crown of the posterior edge of the left lobe close to the spine, where the pleura is reflected upon the ribs: the injury, however, was no deeper than the surface. About a dozen spungy filamentous granulations, or fasciculi of granulations, of a red colour, and about the thickness of a small crow quill, were observed attached to both surfaces of the pleura, and which had been lengthened by the shrinking of the lungs, to half an inch. The colorless lymph was seen oozing out upon the slightest pressure. Such a disease must probably be always fatal, unless the inflammation causing the granulations could be stopped at the commencement: but as cases of this sort, although rare, may sometimes occur and embarrass the practitioner, I thought the above not unworthy of mention.

Hepatitis, or inflammation of the liver, is sometimes said to prove the exciting cause of Phthisis; and cases are upon record, where an abscess in the liver made its way through the diaphragm into the lungs, and where bile was actually expectorated by coughing.

Calculous concretions are sometimes expectorated in consumptive cases, and are supposed to act as the exciting cause; they may, however, be only the symptom of another disorder, Gout, accidentally associated with the pulmonary consumption.

But by far the most frequent exciting cause of this disorder is Catarrh, which being of itself most commonly attended with cough and inflammatory fever, is very often confounded with Incipient Phthisis. The importance of distinguishing one of the most harmless, from one of the most fatal diseases, is sufficiently obvious; and the subject has long exercised the ingenuity of Physicians. The matter ex-



pectorated being in both cases subject to considerable variation in colour and consistence, no accurate judgment can be formed of the disease from its appearance; attempts have therefore been made to analyse the mucus of the Catarrhal, and the pus of the Phthifical cough, with a view of establishing a chemical diagnosis: But although I have repeatedly performed the experiments of Darwin and Broogman on this subject, the result was always too capricious to be confided in; that is to say, it was influenced by circumstances which I possessed not the means of explaining. It should, however, be recollected, that the purulent matter of a phthifical ulcer, must always be more or less mixed with the mucus of the trachea and saliva, in the act of expectoration; from whence the result, were the process in itself ever so decisive, must necessarily be liable to fallacy. The common test of pus sinking in water is for similar reasons fallacious; inspissated mucus being heavier, and purulent matter when mixed with air bubbles lighter, than water; and

hitherto we have no certain criterion for distinguishing the one from the other : but the experienced physician will always be able from concurring circumstances, to form a pretty accurate conjecture.

There is still another very frequent cause of Phthisis which I had almost omitted, and which is deserving of particular notice. About the age of fourteen or fifteen, girls of weak stamina and sedentary habits, are frequently affected with a train of symptoms peculiar to the absence of a certain change which ought about that time to take place in their constitution : such as pallid countenance, indigestion, depraved appetite, costiveness, head-ach, lowness of spirits, langour, debility, difficulty of breathing upon slight motion, pain in the chest, cough, hysteria, &c. constituting chlorosis. From these symptoms, together with the absence of a certain natural evacuation, the disorder is presumed to arise from poverty or scantiness of blood. Accordingly nutritious food, and stimulant



medicines, particularly chalybeates, are supposed to be indicated, and liberally administered. The consequence is, that if the girl is so much *too young in constitution* that the intention cannot be accomplished on the first essay, the dangerous symptoms of cough, pain in the chest, and difficult respiration, instead of being removed, become aggravated more and more; fever supervenes with hæmoptysis and inflammation of the lungs, and confirmed consumption is not unfrequently the consequence of an injudicious and obstinate perseverance in this stimulating deobstruent plan.

I have observed with concern the great proportion of consumptive cases in females of a tender age, which may be clearly traced to this origin, the abuse of tonics and chalybeates. It is a too frequent practice of anxious and impatient mothers, to ply their daughters with chalybeates upon any accidental irregularity about this time of life, from a mistaken notion that some dreadful malady, probably consumption,

must ensue, unless this irregularity is instantly removed: without suspecting that in this they often mistake effect for cause, and that their precipitation is the most likely means of inducing the very disorder they wish to obviate. I have even known mothers so confident in *their* own superior sagacity in this particular, as to controul, or endeavour to controul the medical attendant, whatever might be the risque. The powers and utility of tonics and chalybeates in certain cases of this nature, are well known to every physician and to every quack; but their promiscuous and empirical exhibition is always hazardous, and often mischievous, and cannot be too severely reprehended.

Most cases of chlorosis, whether proceeding from *emanatio* or *suppressio mensium*, are attended with a plethoric state of the whole system instead of a scarcity of blood. Blood-letting therefore, is commonly the safest and most effectual emmenagogue, which often removes the disorder at once, and always alleviates the urgent symp-



toms, cough, pain and stricture of the chest; thereby allowing time for the natural efforts and operations of the constitution. This, with the occasional exhibition of an emetic, and the frequent or constant use of an aloetic laxative, pediluvium, warm bathing, warm cloathing, flesh brush, exercise on horseback, moderate diet, with time and patience, will always remove the disorder with perfect safety. Iron, when the plethora and fever have subsided, may in many cases be exhibited with advantage; likewise opiates and cold bathing, under certain circumstances, and with proper discrimination.\*

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\*I have not enumerated Contagion as a cause of Phthisis, no case having ever occurred to me, where it could be positively traced; and it has always appeared to me more easy and natural, to account for the supposed cases of infection upon other principles. Where several persons of a family become affected with the disorder, one after another, it is in general only a proof of a common hereditary predisposition; and even where husband and wife successively fall victims to the disease, before a proof of infection can be established, it will be necessary to take into the account the great frequency of predisposition to the disease

I have been thus particular in considering the causes of consumption, in order that the preventative treatment might be the more clearly understood : what I have farther to offer on the subject may be comprised in a few words. By an early and persevering attention to the rules and cautions enumerated, the disease will not only in general be warded off, even where hereditary predisposition is strongly marked, but the constitution greatly improved. Where the body has already attained its full growth, and an original tenderness of constitution and proneness to consumption, is confirmed and rivetted by long habit, the task of regeneration

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in this country, together with the hurtful effects of fatigue, watching and confinement, which a person in such circumstances usually undergoes, and which might have been equally injurious, and equally productive of consumption in this person, had the former relative died of dropsy or any other lingering distemper. But the strongest negative proof is afforded by the nurses at the Hotwells, who, were the disease infectious, could not possibly escape ; whereas I never knew any one of them affected with it.



must be proportionably more difficult and uncertain; but in early infancy the prospect is fair and flattering. The venerable Cullen was wont to declare that he never met with a case of rickets where *cold bathing* had been employed from early infancy, a practice not uncommon in Scotland; and as its effects are scarcely less obvious as a preventative of scrophula, and other diseases of weak and irritable solids, there is reason to expect, that by due perseverance, in that practice from the cradle, together with suitable regimen and exercise, as above pointed out, most of the evils of bad stamina might in a great measure be obviated, and the predisposition to consumption eradicated. But as these injunctions cannot always be complied with, nor accidental injuries eluded, the aid of medicine will sometimes be necessary.

The persons most liable to the disorder have been already described: to such persons the symptoms of Incipient Phthisis, cough, pain in the chest, or spitting of blood, are always

deserving of serious attention. A cold, although slight in its attack, must never by them be neglected. If it does not in the course of a day or two give way to abstinence from animal food and strong liquors; if it comes to be attended with fever, tightness across the chest, and cough; if it appears to affect the lungs rather than the head, an adequate quantity of blood should be immediately taken from the arm, and measures adopted for procuring a copious perspiration, such as an antimonial emetic at bed-time, with some warm diluent beverage through the night. If the stricture and pain of the chest should not yield to the first bleeding it ought to be repeated according to the necessity, and a blister applied on the affected part. By this practice the patient will in all probability be perfectly relieved from the complaint in the course of a single night.

It may however be alledged by the careless or the timid, that it cannot be necessary to undergo so many torments at once, for what



after all is probably nothing more than a common cold. But surely no person in such circumstances, who is not totally insensible to danger, will think it a light matter to be freed, in a single night, from the imminent risque of an incurable disease, be the discipline ever so severe. Besides, it is not always easy to distinguish the phthical from the catarrhal cough, and a mistake might be, and often is, fatal. Luckily the treatment in both cases is nearly the same, differing only in degree and necessity.

Phthisis as well as Catarrh being attended with an inflammatory diathesis of the system, every part of the antiphlogistic regimen is clearly indicated in the incipient stage; comprehending a total abstinence from animal food and spirituous and fermented liquors of every sort. The diet should consist of milk, fruits, esculent herbs, and farinacea. The drink, water, milk and water, feltzer water, Bristol water, imperial, &c. In cases where a small quantity of animal food begins to be allowable, a portion of small beer, spruce beer, and such like liquors,

abounding with carbonic acid, might be indulged in preferably to others.

When either from the inveterate nature of the disorder, or from having been so long neglected, the symptoms are not removed by the evacuant and antiphlogistic treatment, the bleeding ought to be repeated, either by the lancet, or by leeches, or cupping glasses applied as near as possible to the affected parts.

A blister kept open, or an issue or seton near the seat of the pain or stricture, will be found of the greatest efficacy in removing them. When the pain arises from an inflammation of the pleura only, these remedies will seldom fail to effect a cure, and even when the substance of the lungs is affected, great relief is constantly obtained from them. As it frequently happens when a blister has been kept open for a length of time upon a spot affected with pain, the inflammation is thereby removed to some other part of the chest, in such cases it will be neces-



sary to change the site of the blister according to the shifting of the pain or stricture.

Internal remedies may be likewise employed with advantage in preventing or moderating the fever, and quieting the cough; such as neutral salts, antimonials, and sometimes opiates.

Riding on horseback has been universally recommended in this and indeed in every stage of this disorder; and undoubtedly, gentle exercise in fine weather cannot fail, in most cases, to have a good effect on the general health: but in the present case it ought to be very gentle indeed, or altogether avoided, as every thing which accelerates the motion of the blood cannot fail to be injurious. The utility of warm cloathing is obvious; and woollen ought to be immediately substituted for linen next the skin. Where the circumstances of the patient will permit, a journey or voyage to a warmer climate, particularly for the winter season is much to be inculcated; where that cannot be complied with, the most sheltered

and eligible situation in England should be resorted to for winter quarters; and where neither of these can be accomplished, the greatest attention possible must be paid to the preservation of the body from cold and sudden chills, by means of warm cloathing, and avoiding exposure to night air, and damp and windy weather.

By an early and sufficient attention to these observations, I am persuaded that nine-tenths or a greater proportion of the cases of threatening consumption might be warded off, and the constitution though naturally delicate, be made to endure the usual term of life.\* But since, either through neglect, or in spite of every precaution, the consumptive ulceration is not always prevented, it will be proper to lay before

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\* It is highly probable that the lives of elderly people, who are very frequently affected with a sort of habitual catarrh, might be prolonged by residing in a warm climate, such as Spain, Italy, or the Indies.



the reader, a summary of the most approved methods of cure or of palliation.

Where ulceration has once taken place, the disease frequently runs its course, as formerly described, in a few months; but at other times it is protracted for several years and even to old age. This seems to arise from the indolent and circumscribed state of the ulcer, from the smaller degree of irritability in the constitution, and the less violence of the fever. To bring about this indolent state of the disorder when ulceration actually subsists, is an indication of the greatest importance; and affords the best prospect of curing the complaint as well as of prolonging life. This is chiefly to be accomplished by a steady perseverance in the plan formerly laid down for the prevention of ulceration, which continues still equally necessary as long as the inflammatory symptoms subsist with violence.

In the more early stages of the confirmed as well as in the incipient consumption, our greatest

dependance continues to rest upon the antiphlogistic regimen, blisters, setons, and particularly the lancet ; whether with a view of palliating symptoms, or of suspending the progress of the disorder. It will however, be frequently objected to bleeding in this stage of the complaint, that the debility is already great, and it might be thereby encreased.

But this objection is founded rather on supposition than actual observation. For wherever the debility is occasioned by inflammatory fever, as in this case, bloodletting by lessening that fever, will invariably be found to lessen the debility ; and in such circumstances the patient would be weakened more by a single night's fever, than the loss of many ounces of blood.\*

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\* The reader will remark, that I have recommended the use of the lancet more freely, in the different stages of this disorder, than the general practice of the present day seems to countenance. I do so, not from any preconceived theory of the disorder, although it appears perfectly consistent with theory, but from actual observation of its



Consumption may no doubt have arrived at that period when no relief could possibly be derived from bloodletting nor low living, and where on the contrary life may be prolonged and symptoms mitigated by a free indulgence in animal food, and wine, or even stronger stimulants. These instances of temporary benefit, frequently

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superior utility. I entered on the practice of physic with prepossessions of an opposite tendency.

In this country, bloodletting, not only in Phthisis but in most other diseases, has of late years fallen into a general discredit, which it is not easy perhaps to account for. I am inclined to suspect that when philosophy came to be applied to physic, and the theories of the old physicians were discovered to be founded on false principles, their practical observations were too frequently discarded along with them, without sufficient consideration. It ought to have been remembered that art in general precedes science, and that the practice of the ancients might in some respects have been good, although their dogmas were fallacious. I will not pretend to insinuate that bloodletting and the antiphlogistic regimen may not have been carried much too far in many cases, within the present century; but certain it is, for some years past, the opposite system has been carried to an equally hurtful excess. So apt is man, in the pursuit of knowledge, to run from one extreme to another.

induce the patient or his relatives to arraign the skill of the physician, and to infer that the disease might have been cured had this practice been adopted sooner: It appears indeed probable, that cases of this sort have been sufficient, for the young and the sanguine amongst medical men, to build a theory upon; and we have occasionally seen pork broth, myrrh, steel, wine, and other stimulants, recommended by authors in the cure of consumption in all its stages.

I will not detain the reader with a description of the various palliative remedies adapted to the relief of each particular symptom that may arise in the progress of this disorder; the application of which must be regulated by circumstances peculiar to the case and the constitution of the patient; but shall content myself with exhibiting a general view of the different means employed with a curative intention. These may be referred to three classes.



1. Remedies which act on the system in general: comprehending diet, bloodletting, emetics, tonics, exercise of gestation.

2. Remedies which act or are intended to act chiefly on the diseased lungs through the medium of the circulating fluids: such as mercury, lead, copper, arsenic, barytes, and other substances of the mineral kingdom, acids, resinous substances, cicuta.

3. Remedies which act on the lungs directly through the medium of the atmosphere: such as, the steam of water inhaled, with or without impregnation from various volatile matter, exhalations of tar or turpentine, vapor of æther with or without cicuta, and similar substances; vapor of vinegar or other acids, carbonic acid gas or fixed air, and various other factitious airs, breath of cows, various powders of vegetable or mineral substances diffused in air and respired.

Upon each of these different heads, regimen and bloodletting excepted which have been already sufficiently noticed, it will be proper to bestow a moment's consideration.

Emetics have been greatly recommended by authors in this stage of the disorder, and cases are upon record where a radical cure was supposed to have been obtained by their long continued daily use. The trials which I have made of emetics in confirmed consumption, have not been attended with the same success as in the incipient; indeed I never found the strength sufficient in confirmed phthisis to support their action when repeated with a view to a radical cure. With *Digitalis* I have not been more fortunate: but I have often perceived beneficial effects from the occasional use of any of the emetic remedies.

Consumption being supposed by some physicians to arise from debility alone, various tonics, such as, iron, Peruvian bark and other bitters



have been recommended, together with the most nutritious animal food and wine. That a great degree of debility always accompanies this disease is unquestionable, and in the latter stages where it is most considerable, or where the system possesses a smaller degree of irritability than common, tonics are sometimes of temporary service. But when we recollect that the debility is only the effect of local inflammation, we cannot expect it to be permanently relieved by tonics: and indeed when the disease appears in its usual form, I have constantly observed tonics of every sort to aggravate the fever, render the cough more troublesome, the expectoration more difficult, the pain in the chest and dyspnoea more considerable. So irritable is the system rendered by this disease, that I have sometimes observed all these inconveniences to arise from the weakest stomachic bitter, such as a cup of weak chamomile tea; and a case has rarely occurred to me, where tonics in any form were at all admissible, except, as was formerly remarked, in the very last stages of the

disorder, and even there they are not always  
serviceable.

Exercise of gestation, whether on horseback,  
in a carriage, or on water, is universally found  
to quiet the cough\* and allay the fever; and  
it is asserted that confirmed phthisis in a very  
advanced stage, has been perfectly cured by  
gestation duly persevered in. Two remarkable  
cases of this sort used to be related by Dr.  
Cullen; one cured by a continued journey of  
several months through various parts of Eng-  
land, and the other by a voyage of several years  
round the shores of the Mediterranean. In  
both cases the greatest debility had taken place:  
the former could not at the beginning travel  
more than five or six miles a day. Sea voyages  
have long been celebrated in the cure of phthisis,

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\* Analagous to this is the well known effect of riding  
in preventing fits of the whooping-cough for several  
hours, while the patient continues on horseback.



and I believe with great justice; but it ought to be observed that as many very great inconveniences are to be encountered at sea, the voyage should be undertaken early: For I have generally understood, when it was delayed until the patient had become very weak, the benefit was greatly overbalanced by the injury, particularly when cold and stormy weather happened to ensue.

Of the remedies which act upon the diseased lungs through the medium of the circulation, none appears more likely at first sight, to prove beneficial in phthisis, than mercury, from its well known powers and subtilty, particularly if we suppose it to be a glandular disease; but experience has not confirmed this expectation, and except where the pulmonary affection arises from one particular cause, mercury has not been found salutary.

It is doubtful whether the other metallic substances enumerated under the second head enter

the circulating fluids, most of them appearing to act on the alimentary canal alone, and perhaps chiefly as emetics. In the trials I have seen made with those substances, little benefit seemed to be derived from any except lead. It is difficult to conceive how this noxious mineral could enter the circulation without violent effects; yet its decided power in stopping pulmonary hæmorrhage and abating inflammation of the lungs, render it probable that it acts through the medium of the fluids rather than the nervous system. Although lead is not a new remedy for consumption, the violent effects which it sometimes produces on the bowels have deterred many practitioners from using it. Much care is undoubtedly necessary in its administration, and great mischief may be done by a remedy of such powers in the hands of the unwary. The dose should be small at first, as its effects are not equally sensible on different persons, and it ought to be desisted from the moment that any unpleasant sensation in the bowels take place. For the greater safety it



should not be continued more than a week or ten days at a time. The most convenient form of the medicine is a solution of the acetated lead in distilled water. In cases of great urgency, I have sometimes administered it in the dose of four grains every six hours; but in ordinary cases of hæmoptysis or inflammation, a smaller dose is more advisable, as it can be longer persisted in, for example, half a grain, or a grain three or four times a day. I have sometimes perceived an evident effect in hæmoptysis, from a single grain, nor have I hitherto met with any unpleasant accident from its use; and although it is certainly attended with some danger, I know of no remedy so well deserving of attention in the cure of this most dangerous disorder.

I have mentioned Barytes under this head, although I have made with it only a few ineffectual trials: the noted effects of the muriated barytes on bad ulcers, and its usefulness in scrofulous cases, afford however, a presumption in its favor.

Considerable temporary benefit is often obtained from the pretty liberal use of acids. They are in general grateful to the stomach, and are found to abate heat and thirst, and sometimes to suspend or mitigate fever. Their effects seem to be chiefly restricted to the *primæ viæ*, and diarrhoea is frequently occasioned or aggravated by them so as to render their farther exhibition inadmissible. I have seldom observed the vitriolic acid to exert any astringent power neither over hæmorrhagy nor colliquative perspirations : on the contrary, it sometimes seems to aggravate both. I have lately given the nitrous acid in pretty large doses with a view to a radical cure, but have not found it to differ materially in its effects from the vitriolic.

The exhibition of turpentine and balsams in this disorder, was probably suggested by their external digestive properties, being frequently employed in ancient surgery for cleansing old foul callous ulcers ; and phthisis being accounted a foul callous ulcer of the lungs, the attempt



was made of applying to it this digestive, through the medium of the circulating fluids. Although few substances possess more acrimony, it is highly probable the Terebinthines enter the circulation largely, from their great diuretic powers, and the odor they impart to the urine, and even to the cutaneous perspiration; it is, therefore, not unlikely they may possess the power of acting on the lungs directly, as local stimulants, independent of their general stimulant properties.

In Italy, these remedies have long been celebrated in the cure of phthisis, and an electuary consisting chiefly of turpentine, with a small proportion of wax and oil, colored with red sanders, and known by the name of Locatelli's balsam, from its inventor, has been received into the shops and pharmacopeias in most parts of Europe. But whatever might be its success in the warm climate of Italy, where the nerves are unfripping by the heat, and the fibres less rigid and less disposed to inflammation, and

where, of course, nervous debility must be proportionally great; its use, after the experience of a century, has been almost abandoned in the northern parts of Europe, where its high stimulant powers are found incompatible with that strong tendency to inflammation, which always accompanies the phthical affections of those latitudes. I have likewise had opportunities of observing its exhibition at Naples, where it is a common enough remedy amongst the natives, in all cases of cough and hoarseness; but in cases of real consumption, it did not appear more salutary than in this country. The terebinthinate remedies happened about that time to have proved injurious to some English phthical invalids to whom they were administered, causing inflammation and fatal hæmorrhagy, for which the physician endeavoured to account from the rigidity of the English fibre. This might possibly be true in some degree, but I was more disposed to account for his favourable opinion of the medicine, from the unfrequency of real consumption among the natives. Slight



catarrhal affections, and some other diseases which may be easily mistaken for incipient phthisis, would in most cases be cured independent of any medicine, and even in spite of bad treatment. The only cases of consumption where I ever observed the terebinthines in any way serviceable or even innocent, were a very few, in which, the inflammatory symptoms were from the beginning uncommonly mild, or had given place to extreme debility, and where the expectoration and colliquative sweats and diarrhoea were extremely great. But wherever the cough is hard and dry, the pulse quick and strong, the heat and thirst considerable, with pain in the chest, and difficult respiration, these medicines are totally inadmissible, and the greatest mischief is frequently done by their empirical exhibition. So great is their inflammatory tendency, that dangerous hæmorrhagy is often brought on by their use in the early stages of the disorder: and at the more advanced periods, and where recovery is out of the question, the strength is so speedily

exhausted, that I have seen patients in this way cut off in the space of two or three weeks, who would in all probability have survived many months, had no such internal cautery been applied.

The transient reputation of these medicines in the cure of phthisis, has arisen from the accidental cure of another complaint which may be very easily, and often is mistaken for incipient consumption, by the unskilful or inattentive. The disease I allude to is chlorosis, which has been formerly described; and as it possesses many symptoms in common with phthisis, it is not to be wondered at that it should be mistaken by the ignorant, or misrepresented by the crafty, however distinct the diagnosis may be to the professional observer. It will not be disputed that chlorosis not unfrequently terminates in consumption when the predisposition is strong, or the treatment injudicious; nothing however can be in its nature more different. In certain circumstances of



chlorosis, as was formerly observed, turpentine, chalybeates and tonics of various sorts, are extremely efficacious, the disease sometimes yielding to them readily; if therefore, this complaint has been accounted consumptive, the remedies will of course be credited, however unjustly, for the cure of this formidable disorder. It ought however to be remarked, that the beneficial effects of these medicines have been almost entirely restricted to the female sex, a circumstance which strongly corroborates the foregoing opinions. To conclude, as these substances are possessed of great powers, they are well deserving of attention from the enlightened practitioner; but for the same reason they must ever be in the hands of ignorance and rashness, most dangerous weapons.

Cicuta was at one time much recommended in this disease, but its celebrity seems at present on the decline. As a narcotic I have sometimes found it serviceable in palliating symptoms; but it is extremely uncertain in its dose and

operation. The total failure of cicuta in the cure of cancer, although ushered into the world with the most respectable attestations, should serve as a warning against implicit faith in new remedies, how great soever may be their reputation.

The remedies of the third class have the obvious advantage of being applied directly to the affected part, so far resembling surgical applications. From the well known relaxing property of warm water, and the salutary effects of steam in resolving inflammatory affections of the throat, there is a presumption in its favor in cases of pulmonic inflammation. Accordingly where the cough is hard and dry and apt to recur in paroxysms, instant relief is often obtained from the inhalation of aqueous vapors; but I cannot bear testimony to its efficacy as a radical cure, having never heard of its being persevered in sufficiently for that purpose, nor indeed with that intention. But in some case it is an useful palliative, and is always easi



procured by breathing through the strop of a tea-pot into which a few table spoonfuls of boiling water has been poured ; but Mudge's inhaler, which may be procured at a trifling expence, is a much more convenient instrument. The mucilaginous or aromatic herbs, sometimes recommended to be infused in the water, appear to be of little importance.

There are some cases on record in which the exhalations of tar or turpentine were found of service in cough supposed to be consumptive : but the *accuracy* of the observers, not being professional men, cannot escape suspicion, although the fullest credit is due to their veracity. These cures are said to have taken place from breathing the atmosphere of tar warehouses in America, or that of manufactories for boiling and refining tar or turpentine in this country. The practice must be attended with considerable trouble in either case ; but certainly the warm moist air of such boiling houses may fairly be presumed to possess a powerful influence on

the lungs, independant of any impregnation from the tar ; although no medical practitioner has taken the trouble of investigating the subject.

The vapor of vitriolic æther inhaled, has sometimes the power of instantly stopping a fit of coughing, and relieving dyspnœa ; but in all the cases where I have seen it employed, these effects were but temporary, and it soon lost the power of affording even temporary relief. In many instances (perhaps the greatest number) wherein it was perseveringly used, hoarseness was produced by it and a degree of sore throat. In some cases, this inflammatory affection seemed to extend from the fauces into the lungs, creating or aggravating cough, dyspnœa pain and stricture to an alarming degree, in one case rendering copious bleeding necessary. The effects of æther medicated with opium, cicuta, hyoscyamus, &c. are not sensibly different, so far as I have observed or been informed.



In this way the vapors of vinegar might be inhaled, and of other acids, were they presumed to be salutary ; but all of them, with the exception of the carbonic acid gas, appear too stimulant and irritating to the lungs, to be useful or admissible in this complaint. But previously to the farther consideration of this and other factitious airs, it may be necessary to say a few words on the composition of the atmospheric air.

By the discoveries of Priestley and Lavoisier, atmospheric air has been ascertained to be a compound of two different sorts of airs or gasses, viz. oxygen, or vital air, and nitrogene, azote, or phlogisticated air ; in the proportion of 27 of the former to 73 of the latter, in the hundred parts of atmospheric air. In some places, one part or two, in the hundred, is found to be carbonic acid gas. Of these, the oxygene alone, contributes to sustain life or flame ; the others, which constitute nearly three-fourths of the whole, being useless or noxious in the un-

mixed state. But it is found that oxygene, pure and undiluted, is too stimulant for the ordinary purposes of respiration, tending to produce an inflammatory disposition of the whole system: and it has been supposed that even the common proportion of oxygene in the atmosphere, may, in certain conditions of the lungs, for example in phthisis, possess a degree of stimulating power, unfavorable to health. It has, therefore, been proposed, in such cases, to superadd a quantity of some *unrespirable*\* air, with a view of simply diminishing the proportion, and of course the stimulus of the oxygenous part. It is, however, highly probable, that each of these gasses is endowed with a specific power of action on the living body, independent of the mere subtraction of stimulus; although hitherto little more seems to be ascertained on the sub-

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\* *Azotic air* is a better term, but it might have been confounded with that particular species of azotic air called *azote*, by the French Chemists.



ject, but that all of them, with the exception of oxygene, have the property of diminishing the action of the heart ; from which it is reasonable to infer, they diminish the irritability of the nerves, and the tendency to inflammation.

The factitious airs which have been chiefly employed in the cure of consumption, are the carbonic acid gas, the carbonic inflammable gas or hydro-carbonate, and the hydrogenic gas, oxygene gas, for the reasons formerly mentioned, being thought inadmissible in this disease.

It is many years since the carbonic acid gas was observed to possess salutary powers, when applied to ulcers externally ; in consequence of which, it was recommended by Dr. Priestley I believe, to be inhaled, as a direct application to phthifical ulcers. In some cases of this sort, it has been found useful in lowering the pulse, relieving dyspnœa, and correcting the fetor of the expectorated matter ; but sometimes, on

the contrary, it is observed to encrease the cough and dyspnoea: this, however, may be owing to something extraneous mixed with the gas.

The sedative powers of carbonic acid, as was formerly stated, seem to proceed, not from the simple subtraction of stimulus, by lessening the quantity of vital air respired in a given time; but from some inherent sedative property of the gas itself. Upon this supposition, the sedative effect will be according to the encrease of the carbonic gas in a given bulk of air, and not according to the diminution of the oxygene gas. But as carbonic gas, (being destructive to life), could not be administered unmixed, the greatest possible effect would be obtained, by mixing with this gas, as small a portion of pure vital air as could serve to sustain animation, whereby the inert azotic gas would be totally excluded, and a proportionably larger quantity of carbonic gas substituted in its room. In this way it may



be respired in very large proportion with safety and advantage.

The methods of procuring it are various. The most common, is from a mixture of chalk and vitriolic acid: but it is to be suspected, that in this way some of that acid arises with the gas. It is obtained in large quantity from burning charcoal, or limestone calcined in close vessels, which last is, perhaps, the purest of any; and it is not improbable, that the gasses obtained by these various methods, differ essentially in some of their properties and effects. The air of wine-cellars and malt-houses is strongly impregnated with this gas, which is extricated from the fermenting vegetable matter, and has been, as well as the air arising from limekilns, immemorially celebrated in diseases of the chest, among the labouring people. But I have never observed any cure of phthisis, nor any very lasting benefit from this remedy, in any form.

The heavy inflammable gas obtained from charcoal, to which the ingenious and scientific Mr. Watt has given the name of hydro-carbonate, is possessed of very great powers on the animal economy. When respired, it generally causes vertigo, with a diminution of the frequency of the pulse, although very largely diluted with atmospheric air. It is likewise found to redden the flesh of animals, and to render it more tender. From its sedative properties, it has been considered well adapted to phthical complaints, and considerable benefit is said to have been derived from it.\*

Of the efficacy or utility of this, and other remedies of the same class in consumption, my

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\* The general properties of this and the other gasses, together with the method of preparing them, are very clearly and fully explained by Mr. Watt in the printed description of his Pneumatic apparatus. In the annexed reports by Dr. Beddoes may be seen the effects of these gasses in the cure of diseases so far as they are yet ascertained.



own experience has been too limited to justify me in delivering an opinion. In the few cases where I had an opportunity of administering them, or of observing their effects, they proved unsuccessful. But these were cases of the most unfavourable kind; being generally such as afforded no room for expectation of recovery by the ordinary treatment. It will, no doubt, be alledged, that such cases are fair, and the only fair cases for the experiment; because where the patient is likely to do well by the usual method of cure, or by the efforts of nature alone, the recovery cannot be considered as a proof of the efficacy of a new remedy.

There is, however, much reason to fear that no essential nor general advantage in phthisis can be obtained from the factitious airs, in the partial and inefficient manner they are at present administered in, be their virtues what they may. The portion of the day is comparatively small in which they can be used, and there are many patients who cannot be made to inspire through

a tube without a painful and hurtful effort, for which the mouth pieces that have been invented, afford but an imperfect remedy. These inconveniences, indeed, might be obviated in a great measure, by fitting up a small closet in any dwelling house, for the purpose, in which the patient might sit at his ease, read, and amuse himself in various ways, for hours at a time, breathing without any effort, the factitious air, which could be supplied from time to time, or constantly, if necessary. This could be accomplished at a very small expence, as common paper varnished, or slips of oiled silk or linen would serve to render the walls and crevices almost impervious to air, and the door might easily be so shaped and armed with leather, as to become sufficiently air-tight.\*

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\* Some time ago I had a portable apparatus constructed upon these principles, in the form of a sedan chair, which I have found to answer the purpose extremely well.



But besides these obstacles, it is often difficult in private practice to procure the gasses, and the necessary apparatus and materials are attended with considerable expence to individuals. This evil can only be obviated by the Apothecaries in general adopting the practice of preparing the gasses in common with other remedies, which could be easily done, with the apparatus above referred to, by any one possessed of the most moderate chemical knowledge, or the smallest turn for mechanism or experiment. This would likewise prove the most effectual means of divesting pneumatic medicine of that air of mystery or singularity, which tends so much to prevent it from coming into general use, or at least, from obtaining a full and fair trial.\* Every lover of experimental

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\* Another advantage to the healing art would likewise result from this practice, as it would necessarily tend to accustom Apothecaries to Chemical studies and manipulations, which, it is to be regretted, are at present too much neglected by that branch of the profession, where the

inquiry must be anxious to see the Pneumatic institution projected by Dr. Beddoes, carried into effect; whereby the powers of these remedies would be ascertained more fully and accurately than could otherwise be done. The inevitable expence of such an establishment must tend, I am afraid, to retard its execution. In the mean time, it appears to me, that the purpose might be effected in a great measure, in any hospital or infirmary, at a very moderate charge; as no additional expence, except that of the pneumatic remedies, and the fitting up of a couple of rooms, which could not be great, would be incurred; house room, medical attendance, and other necessities, being already found.

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original province and duties of preparing and dispensing the medicines seems to be in a great measure forgotten, or exchanged for the more hazardous and responsible office of prescribing them, which, evidently demands an education entirely different in kind.



The ingenious Dr. Darwin has described a very simple and easy method of diffusing in the atmospheric air, certain substances, such as Bark in powder, white lead, &c. which by inhalation might be applied directly to the diseased lungs. None of the modern improvements in the cure of phthisis appear more plausible than this; and although I know but of few cases where it has been employed, and only one where it was attended with much advantage, the nature of the remedy justifies a strong presumption in its favor. It is natural to entertain doubts of the innocence of some of these substances received into the lungs, such as Ceruse, but I have not heard of any instance where *Colica Pictonum*, or any other bad consequence followed the experiment. Some coughing, at first, will naturally be expected.\*

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\* The lungs in the sound state at least, do not appear to be so sensible to many stimuli as is generally supposed. I remember in 1787, when employed at Edinburgh with some investigations and experiments on the nature and cause of Asthma, to have injected several ounces of water into the

The breath of ruminating animals, particularly Cows, has been immemorially accounted salutary in disorders of the chest: but the prac-

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lungs of a dog through an opening in the trachea; but instead of suffocation which I expected to ensue, no apparent inconvenience to the animal arose from it, except some convulsive efforts of coughing, for a few seconds while the water was in the act of descending; and next day when the lungs were inspected, the water was entirely absorbed or evaporated. \*The experiment was repeated on another dog with water in which some powder of Ipecacuanha was diffused, with hardly any other effect. Next day he was perfectly well. Several drachms of quicksilver were injected into the lungs of another dog, which occasioned the same convulsive efforts while descending, which however did not last more than a few seconds, and the animal continued to breathe in the ordinary way without the smallest cough, and ate his food as usual. When killed twenty-four hours after, the substance of the lungs were rendered blue in the interior parts by the mercury, most of which had by some means been so minutely divided as to lose entirely its metallic lustre, and had insinuated itself into the vessels or air cells to a considerable extent. Had the dog been suffered to live, it would have been curious to observe the farther effects of the mercury; but my investigations extended at that time to the irritability of the lungs only, and it is not justifiable to multiply these cruel experiments without some very definite purpose.



tice had fallen into disuse (at least with medical men), until of late, that some trials have been made with it again, both on the continent and in this country. The success attending these trials, so far as I have been informed, has not been equal to expectation. The experiment, however, is harmless.

Such are the usual remedies, and principal modern improvements in the treatment of Consumption. The foregoing account of them, although very imperfect, will, I hope, enable the reader to form some idea of their respective efficacy, and thereby tend to remove the too great partiality or prejudice which often exists in favor of some remedies, against others, to the no small embarrassment of the physician, and detriment of the patient.

It is a subject of much regret, that we have not yet attained the knowledge of any certain cure for this hitherto fatal disorder: But it is

sincerely to be wished that the spirit of investigation which characterises the physicians of the present day, may not slacken on a subject so interesting to mankind. May it meet with that applause which it justly deserves, and may its exertions at length be crowned with success!

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to be added that the first of these  
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the patent law, may not be taken as a subject  
the patent law, may not be taken as a subject  
that appears to be the case, and may  
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